MACHINERY

Design—Construction—Operation

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To dispose of two million pounds of sheet metal scrap a week is a formidable job. How this is efficiently done at the Chevrolet plant in Flint is the subject of the leading article in July MACHINERY. Other subjects to be dealt with in that number will include *Methods for Estimating Time Required for Machining,* based upon the practice of a large electrical manufacturer, and *Typical Operations in Making Ford Gages,* describing work performed at one of the small "decentralized" Ford plants located in the country.

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CIRCULATION, 16,156


STAMINA! for
L & S LATHES
THE TRIPLE GEARED SELECTIVE HEAD LATHE
THE WORLD TURNS BEST

MACHINERY

Volume 43 NEW YORK, JUNE, 1937 Number 10

Is the Small Rural Plant Practical for Mass Production?

Henry Ford Answers in the Affirmative on the Basis of His Complete Success with Fourteen Small Shops Established in Rural Communities

By CHARLES O. HERB

IN these days of upset economic conditions, the idea of moving industrial plants into farming districts is frequently advanced as a partial solution to some of our difficult social problems. This would reduce the tendency of labor to drift citywise, would bring greater income to rural communities, and would enable factory workers to have better homes and food.

It is easy enough to theorize on an economic question of this sort, but business men want to know whether such a plan could be carried out practically. The answer may be found in the successful experience of Henry Ford, who has proved that decentralization of industry is sound and profitable both for the worker and management, if it is carried out in an intelligent manner. Seventeen years ago, he established a small machine shop in the village of Northville, Mich., for manufacturing all of the valves used in Ford automobiles. Since then, thirteen more small plants for the pro-

A Machine Shop in the Country, where the Lighting is Unobstructed by Neighboring Buildings and where the Views through the Windows are Pleasant Rural Scenes. All the Roughing Operations are Performed on the First Floor, which is Shown Here

duction of gages, tools, automobile starters, generators, lamps, and other parts have been established by Mr. Ford in different rural locations within a radius of fifty miles from Detroit.

These plants are no longer an experiment; they have proved that small plants can be operated by the Ford organization as efficiently and with as low costs as similar departments concentrated in the huge River Rouge plant at Dearborn. In 1935, these little factories employed approximately 2500 persons. At the present time, an additional plant is nearing completion and the erection of other plants is being contemplated.

Each of These Countryside Factories Lies in a Picturesque Setting

All these plants are located along the banks of either the River Rouge or the Huron River, and are operated by water power from those streams. In each case, a dam is built above the factory and the water flows to and away from the building in races reminiscent of the days when grist mills dotted the countryside.

The Ford Motor Co. owns acres of land surrounding each plant and has landscaped the adjacent grounds so that all buildings present a picturesque appearance. When the workman in any of these plants glances through the windows, he looks upon green fields and trees, blue sky, and pleasant streams. Farm houses, instead of crowded city blocks, are seen in the distance.

All Small Ford Gages are Made in the Waterford Plant

Thousands upon thousands of the gages required in Ford plants are produced in the 38- by 144-foot factory here shown, which is located at Waterford, Mich. The excellent working conditions will be apparent from the interior views. Daylight, unobstructed by neighboring buildings, undoubtedly helps in producing the gages to the extreme accuracy demanded—it is claimed that all the gages made here are produced to specified dimensions, many within eight millionths of an inch. On the average, 500 gages are produced every day. The plant is never operated at night.

From sixty-five to one hundred toolmakers are regularly employed in this plant. Most of them live in neighboring villages, of which there are four or five within a radius of three miles. Here they have gardens in which they can raise vegetables and fruit to cut down living expenses. Some of the men live on small farms. Everyone rides to work in an automobile.

The power required for running the plant is mainly derived from a water turbine. In addition,

This Countryside Plant is a Model of Efficiency. Five Hundred Gages are Turned out in an Eight-hour Day, Some of them Accurate within Eight Millionths of an Inch. This Illustration Shows the Second Floor where the Finishing Operations are Performed

there is a motor-generator set for emergencies. The total rating of all motors in the building is approximately 200 horsepower. It is interesting to note that in the twelve years that this plant has been in operation, there has always been sufficient water on hand for running the turbine.

Each Man is His Own Inspector

There are no inspectors in this factory, each man being responsible for his own work. To enable him to obtain the accuracy demanded, he is provided with adequate checking facilities. For example, the operators of all internal grinding machines are furnished with Johansson internal indicators; the operators of cylindrical grinding machines with Sheffield electric gages; and the bench men with either Zeiss Optimeters, Sheffield electric gages, or Northside amplifiers.

There are thirteen sets of Johansson gage-blocks in constant use for setting the various inspection devices and checking important dimensions. Even these gage-blocks are not relied on indefinitely—every two months three sets are replaced with new gage-blocks, so that no one set is used as long as a year. An article that will describe in detail some of the gage-making operations in this plant will appear in July MACHINERY.

While this article has described a plant that largely employs skilled labor, the other countryside plants of the Ford Motor Co. are strictly of the quantity production type. In several of them, where dexterous fingers are required for the handling or assembling of small parts, many of the employes are women.

* * *

Meeting of Society for Testing Materials

The fortieth annual meeting of the Society for Testing Materials will be held at the Waldorf-Astoria Hotel, New York City, June 28 to July 2. Papers and reports relating to almost every kind of engineering material will be presented. At least four papers will deal with important topics pertaining to cast iron. The tensile strength of this material and the correlation of physical properties of cast iron, and the thickness of castings, will be covered. Another paper will deal with transverse tests of cast iron and the effects of various factors. Several papers dealing with non-ferrous metals will also be presented.

In conjunction with the meeting, there will be an exhibit of testing apparatus and related equipment. The Society has sponsored several such exhibits, of which this is the fourth. They are held at two-year intervals.

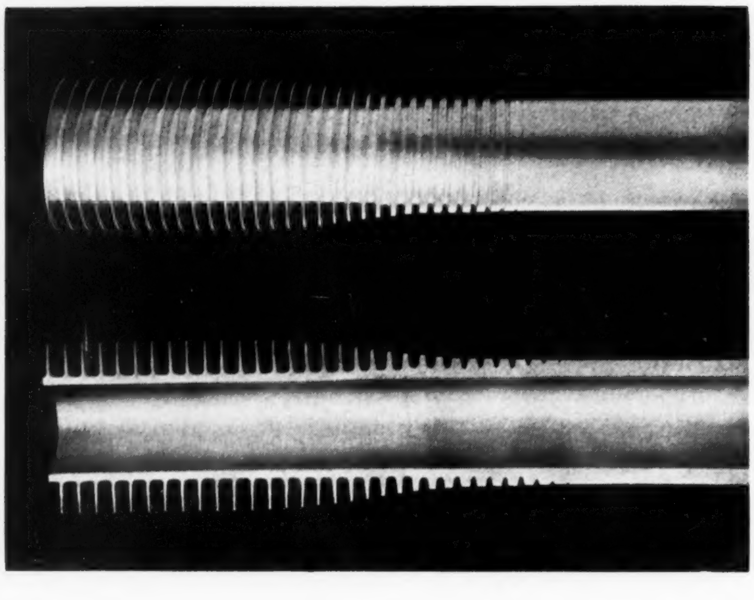


Fig. 1. *Tubing with an Integral Heat-radiating Fin is Produced from Plain Seamless Tubing by the Wolverine Tube Co. through a Patented Process that Involves the Squeezing of Metal Displaced by Rolling*

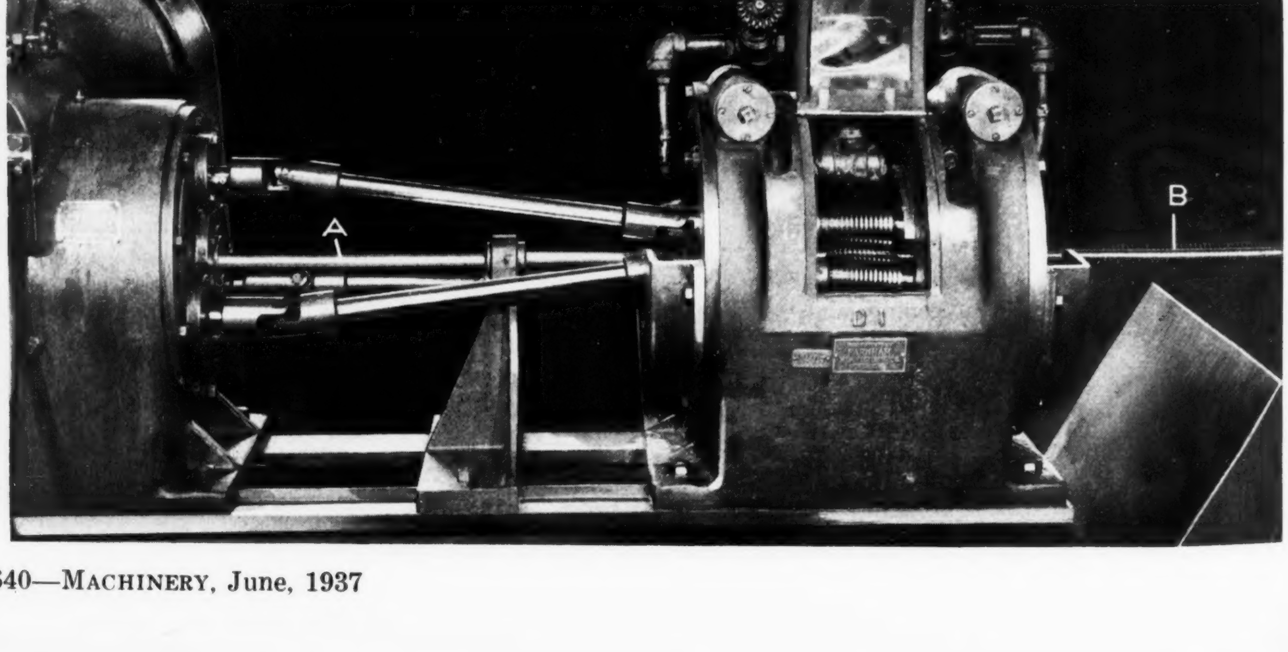
Fig. 2. *Machine that Produces Finned Tubing as Seen at B from Plain Tubing A Fed Between the Forming Tools. Tubing is "Finned" at the Rate of Several Feet a Minute*

Rolling One-Piece

COPPER and aluminum tubing with a helical fin that is rolled from the tube wall itself so as to form a completely integral product is manufactured in large quantities by the Wolverine Tube Co., Detroit, Mich. This finned tubing is used in high-temperature and high-pressure equipment, such as air-compressor coolers, unit heaters, drying and curing ovens, refrigeration cooling units, and condensers. The fin greatly increases the external surface area of the tubes, and facilitates the radiation of heat from the fluid or vapor being conveyed through the tubing.

The patented process by means of which this finned tubing is manufactured consists of feeding plain seamless tubing between three rotary forming tools, which first press a helical groove into the tubing, and then exert a squeezing pressure sidewise on the displaced tube material between the grooves. The various stages in the forming of the fin will be understood from Fig. 1, which shows two views of a partially formed finned tube that has been sawed in half lengthwise. A general view of the "finning" machine is shown in Fig. 2, the plain tubing being fed to the forming tools as seen at *A*, and the finned tubing leaving the tools as seen at *B*.

A close-up view of the forming tools is shown in Fig. 3. Each tool consists of a series of disks of varying shapes which are designed to form the fin gradually in the manner explained. At the



Finned Tubing

time that the photograph shown was taken, the machine was set up with tools consisting of fifteen disks each. The first seven or eight disks form the groove to an increasing depth, and the remaining disks exert the sidewise squeezing action which makes the narrow continuous fin considerably larger in diameter than the original tubing.

The forming tools are placed at an angle with respect to the tubing, so as to form the fin to the desired helical angle. This angular setting of the tools is readily adjustable to suit tubing of various diameters. All three forming tools are adjusted simultaneously by simply swiveling a universal plate. Tubing of 3/4 inch outside diameter to start with has a diameter of about 1 1/4 inches across the fin at the end of this operation, and a root diameter of 5/8 inch. The fin has a lead of about 1/4 inch and is 0.015 inch thick along the outer edge. Fins are produced on tubing of this size at the rate of approximately 2 1/2 feet a minute.

Finned tubing is manufactured by the concern from plain tubing as small as 3/8 inch and as large as 4 inches. Coils can be made from tubing of this type by simply winding it around a mandrel on a lathe, as illustrated in Fig. 4.

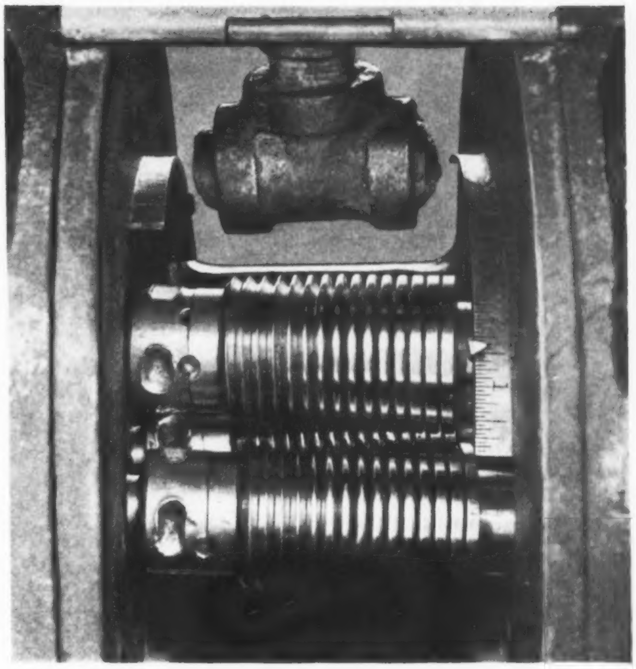


Fig. 3. The Fin-forming Tools Consist of a Series of Disks of Varying Shapes. Each Disk is Inclined at an Angle, so as to Form a Continuous Helical Fin

* * *

Training Workers for Cleveland Industries

A concise report entitled "Training Workers to Man Cleveland's Industries" has been published by the Committee on Vocational Education of the Associated Industries of Cleveland, Ohio, 1615 Guarantee Title Building. This report briefly summarizes the facts relating to the scarcity of skilled labor and the need for apprentice training. While particularly applied to Cleveland industries, the general principles would find application in any industrial community. The report, therefore, will prove of value to manufacturers in any industrial center who may be planning to take steps for providing adequate industry training. Warner Seely, secretary of the Warner & Swasey Co., is chairman of the committee responsible for the report.

Fig. 4. Finned Tubing can be Readily Formed into Coils by Winding it Around a Lathe Mandrel

* * *

List of Industrial Exhibitions

A supplement to the 1937 schedule of shows and expositions covering exhibits in most of the industries, trades, and professions is available through the Exhibitors Advisory Council, Inc., 330 W. 42nd St., New York City, at the price of $2 each. This supplement gives the names, dates, and locations of some 400 exhibitions.

Finishing Cylindrical Work by Burnishing Rollers

Locomotive and Car Journals, Piston-Rods, and Crankpins are Finished Accurately and Economically with Stellite Rollers

By R. K. KENNEDY
Haynes Stellite Co., New York City

THE alloy burnishing roller—a quick, effective tool for finishing driving-axle journals, car-axle journals, and other locomotive parts—furnishes a good example of how tool modernization can increase efficiency and reduce railroad maintenance expenses. The economy of this method of surface finishing is outstanding when compared with other methods, but most important is the really better and more lasting surface produced by rolling. Smoothness, as shown under a low-power microscope, is attained to an extremely high degree by burnishing. Filing is entirely eliminated. Car journals, crankpins, truck axles, or piston-rods can be rolled after being sized, thereby eliminating a finish-turning operation. Only one or, at most, two rollings are necessary to produce a superior wearing surface.

Rolling the surfaces is a form of cold mechanical work. The irregularities of the metal are smoothed out, and any high spots are "flowed" cold into depressions. Imperfections are rolled out quickly and easily. A definite advantage is gained in this way, since the cold work hardens the surface of the metal considerably. Such hardened surfaces naturally wear much longer.

A number of railroads have standardized on Stellite rollers, such as shown in the accompanying illustrations, for rolling car-axle and locomotive driving-axle journals, engine-truck axles, crankpins, air-pump rods, piston-rods, and various other locomotive parts. In many shops, piston-rods are rolled in a standard engine lathe with the same type of roller as is used on car-axle journals. The roller is held in a tool-holder and set up against the rod as tightly as is necessary, and the regular feed is applied. A piston-rod 4 inches in diameter and 48 inches long is rolled or burnished in this way, as shown in Fig. 1, in fifteen minutes. Using a surface speed of 150 feet per minute and a feed of 3 1/16 inches per minute, only one rolling operation is required—a good example of how the operation makes for both speed and economy.

Fig. 1. Rolling a Locomotive Piston-rod, 4 by 48 Inches, with Stellite Burnishing Roller in Fifteen Minutes

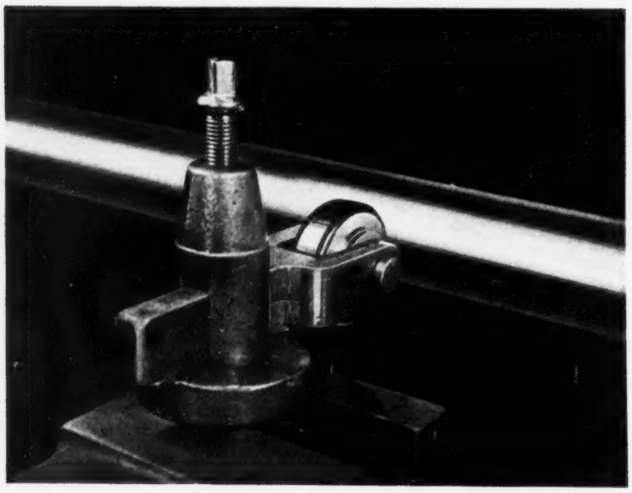
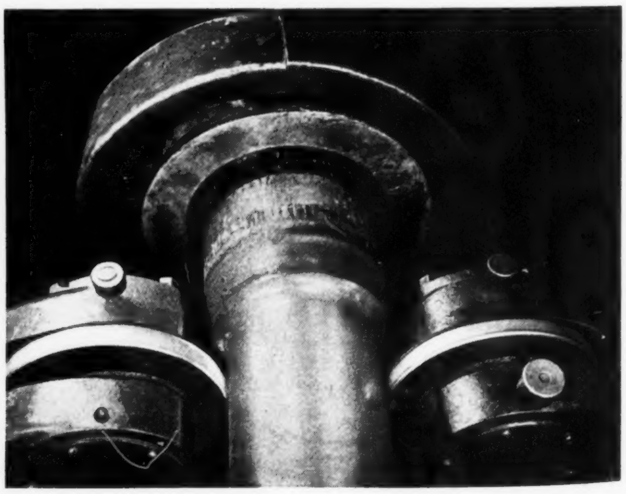


Fig. 2. Close-up View of Two Opposed Rollers Used on Standard Car-axle Burnishing Machine



Why Tool Costs are Low

The alloy roller shown in Fig. 1 has been in service for over two years. Similar rollers have been in service in other shops for over five years, some having burnished over 21,000 car-axle journals without involving any expense for maintenance. In another shop, a roll was purchased at a cost of less than $100, instead of an expensive grinding machine. The low over-all maintenance expense is due largely to the wearing qualities of the Stellite roller, which is an alloy of cobalt, chromium, and tungsten. The metal is quite hard, has a low coefficient of friction, and therefore wears well. In addition, it retains a fine finish which is imparted to every piece that it burnishes.

Burnishing Both Ends of Car Axle Simultaneously

A standard car-axle burnishing machine in service in an eastern railroad shop makes use of four Stellite rollers. These rollers are double-opposed, as shown in Fig. 2, two rollers burnishing each journal of a car axle at the same time and finishing both journals in an over-all time of seven minutes. With the axle turning at the rate of 75 revolutions per minute and a roller feed of 5 1/2 inches per minute, the two journals, each 10 inches long, can be rolled in about two minutes. In this case, each journal is rolled twice to insure great accuracy.

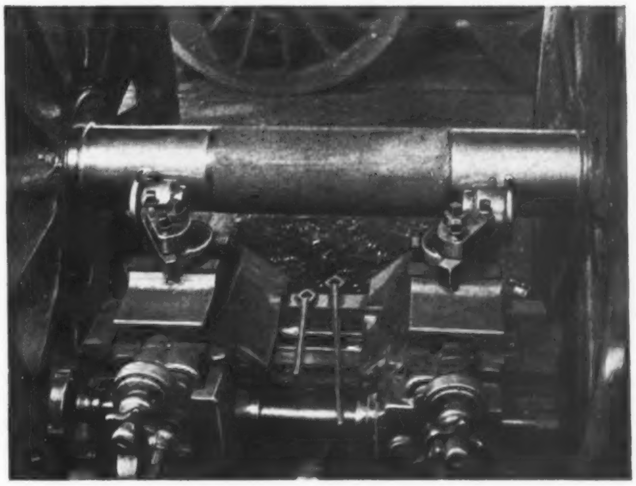


Fig. 3. Rolling Journals of Locomotive Driving Axle After the Wheels have been Assembled

The fact that rollers can do a job formerly requiring several grinding operations, and do it more quickly and satisfactorily and at lower cost, is a tribute to the ingenuity of the toolmaker. It is now just as easy to change a lathe over for burnishing as it is to change a cutting tool. Thus plant and tool modernization in up-to-date railroad shops now includes rolling as one of the first operations to be considered.

Annual Meeting of Gear Manufacturers

THE American Gear Manufacturers' Association held its twenty-first annual meeting at Galen Hall, Wernersville, Pa., May 24 and 25. As usual, a large number of members were present at the meeting, which consisted of four active sessions. A great deal of attention was given to the reports of the various standardization committees, the Association having always been very active in standardization work.

The opening address of the meeting was made by the president of the Association, E. S. Sawtelle, president of the Tool Steel Gear and Pinion Co., Cincinnati, Ohio. Mr. Sawtelle reviewed the activities of the gear manufacturing industry and referred to the important problems of business and industry in general.

A number of papers, several of which will be abstracted in coming numbers of MACHINERY, were read before the meeting. Among these the following should be especially mentioned: "Foremen and Foremen Training," by Neal Foster of the Boston Gear Works, Inc.; "Wage Incentives," by H. H. Kerr, president of the Boston Gear Works, Inc.; "Plant Management," by N. M. DuChemin, assistant manager, West Lynn Works of the General Electric Co.; "Credit Unions," by E. S. Sawtelle, president of the Tool Steel Gear and Pinion Co.; "Gear Castings with Reference to Cast Iron," by O. Smalley, president of the Meehanite Institute of America; "Casting Steel in Cement Bonded Sand Molds," by H. F. Scratchard, industrial engineer of the Birdsboro Steel Foundry & Machine Co.; "Automobile Transmissions," by J. O. Almen, head of the dynamics department of the research laboratories of the General Motors Corporation; and "Application Factors for Helical and Herringbone Speed Reducers," by S. L. Crawshaw, application engineer of the Westinghouse Nuttall Works.

* * *

General Electric Pension Payments

In 1936, the General Electric Co. paid in pensions to retired employes $2,548,275. On December 31, 1936, there were 3292 persons on the pension rolls. The average length of continued service of each person receiving a pension was 29.4 years. The average age of the pensioners was sixty-eight, and the average pension, $769 a year. Since the pension system became operative, a total of over $18,000,000 has been paid to retired employes.

Broaching a T-Slot in Steering-Gear Shafts

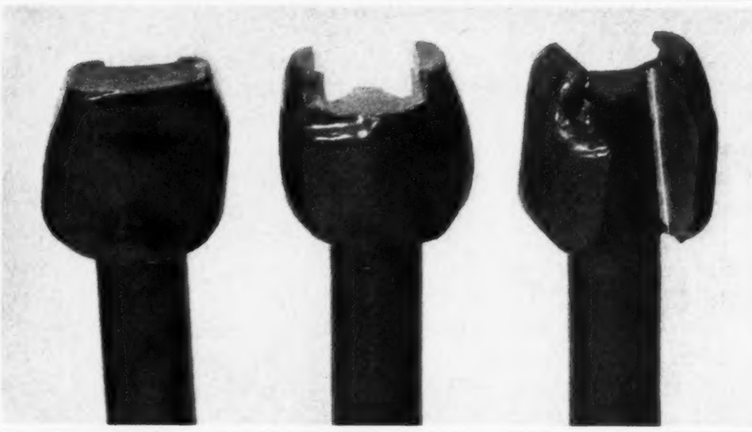


Fig. 2. Three Stages in Machining a T-slot in Steering-gear Shafts

THE broaching of a deep T-slot in automobile steering-gear shafts is performed at the high rate of 190 pieces an hour by the machine illustrated in Fig. 1. The nature of the operation will be apparent from Fig. 2, in which the left-hand view shows the end of the steering-gear shaft as the part reaches the broaching machine. The middle view shows the shaft after the rough broaching, and gives an idea of the large amount of stock that is removed in that step of the operation. The right-hand view shows a steering-gear shaft in which the T-slot has been finish-broached. This example, however, has also been broached at right angles to the T-slot in a subsequent operation.

The machine is of the dual-ram type, has a stroke of 36 inches, and is of ten tons capacity. It was built by the Colonial Broach Co., Detroit, Mich. The two rams enable the T-slot to be both rough- and finish-broached in the same machine. In Fig. 1 the machine is shown with the left-hand or roughing ram at the bottom of the stroke and with the right-hand or finishing ram at the top of the stroke.

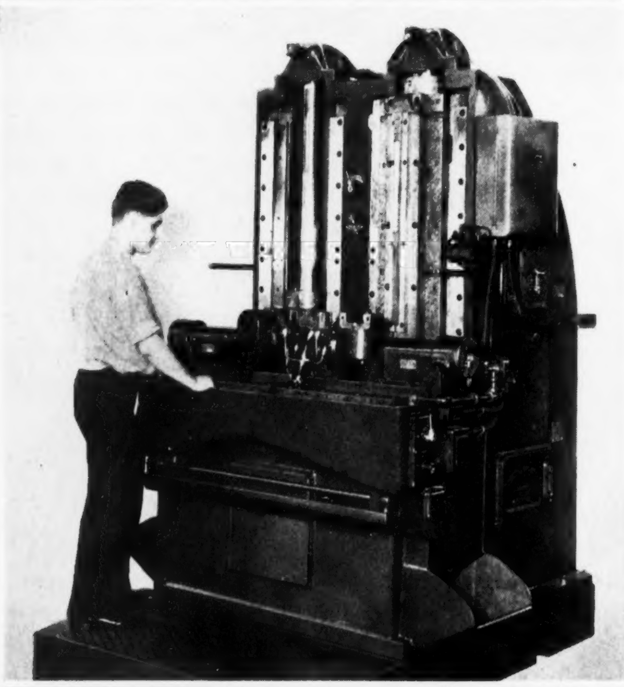


Fig. 1. Dual-ram Broaching Machine which Takes an Unusually Heavy Roughing Cut and a Finishing Cut in Forming a T-slot in Steering-gear Shafts

The machine fixtures are of a trunnion design that tip upward automatically at the end of the stroke. With this arrangement, one fixture can be loaded while work in the other fixture is being broached, thus permitting a continuous cycle to be maintained. Swiveling of the fixtures is accomplished through a rack-and-pinion mechanism, operated hydraulically in synchronism with the rams.

* * *

Improved Machinery Makes Higher Wages Possible

In the final analysis, we cannot pay higher real wages without greater efficiency. When a man is paid higher wages, he should produce proportionately more to justify them. You can only go so far in obtaining this increased production from manual effort. The real solution of the problem falls on management. It is necessary for management to make the workers' efforts more effective. This can be chiefly done (1) by better equipment, (2) by better planning, and (3) by more economical sales and distribution efforts.

Briefly, what is needed is better machinery that will operate at a higher rate of speed, or that will produce at the same rate but require less attention and upkeep; and better working conditions, because even with the best machinery there must be good health conditions, good floors, good light, good ventilation, and ample safety devices. Sickness, fire, and accidents still take too great a toll from industry. Factories must be laid out so as to prevent waste of effort; methods must be improved, so that the same or better quality can be obtained with less effort; and the right materials must be on hand when needed to prevent waste of time in waiting for supplies. Efficiency in sales methods will reduce sales costs, and transportation facilities must be studied and selected with a view to economy.—*R. L. Rickwood, Superintendent, Blanchard Machine Co., Cambridge, Mass., before the Boston Branch of the National Metal Trades Association*

CIRCULAR AND DOVETAIL FORMING TOOL BLANKS—1

Table 1. Machine Group Classification

Group Number	Type of Machine	Model	Maximum Capacity
1	No. 00 Brown & Sharpe	Standard	3/8
	No. 00 Brown & Sharpe	Universal	3/8
	No. 00 Brown & Sharpe	High Speed	3/8
	No. 00 Brown & Sharpe	Threader	3/8
	No. 19 Brown & Sharpe	......	3/8
	Index "0"	......	7/16
	3/8 Cleveland	Models A & B	3/8
2	3/8 Gridley	Model R6	3/8
	1/2 Davenport	Model B	7/8
	9/16 Acme Gridley	Model C	9/16
	9/16 Gridley	Model R6	9/16
	No. 0 Brown & Sharpe	Standard	5/8
	No. 0 Brown & Sharpe	High Speed	5/8
	5/8 Cleveland	Models A & B	3/4
	5/8 × 7/8 Cleveland	Model B	1 1/16
	No. 204 New Britain	......	5/8
	7/8 Greenlee		1
	7/8 × 1 1/4 Cleveland	Models A & C	7/8
3	7/8 Gridley	Model R4	7/8
	7/8 Gridley	Model G	7/8
	1 Gridley	Model R4	1
	1 Gridley	Model R6	1
	1 Acme Gridley	Model C	1
	No. 172 New Britain	......	1
	No. 2 Brown & Sharpe	Standard	1 1/8
	No. 2 Brown & Sharpe	High Speed	1 1/8
	1 1/4 Gridley	Model R6	1 1/4
	1 1/4 Cleveland	Model A	1 3/8
	1 1/4 × 1 1/2 Cleveland	Model A	1 3/4
	1 1/4 Cleveland	Models B & C	1 3/8
	1 1/4 Cleveland	Model B	1 1/4
	1 1/4 × 1 1/2 Cleveland	Model C	1 1/2
	1 1/4 Greenlee	......	1 1/4
	1 3/8 Gridley	Models G & Ga	1 3/8
	1 3/8 Gridley	Model R4	1 3/8
	1 1/2 Greenlee	......	1 1/2
	1 5/8 Gridley	Model GA	1 5/8
	1 5/8 Gridley	Model R4	1 5/8
4	1 5/8 Gridley	Model R6	1 5/8
	1 5/8 Acme Gridley	Model C	1 5/8
	No. 206 New Britain	......	1 5/8
	No. 415 New Britain	......	1 5/8
	No. 410 New Britain	......	...
	1 3/4 Gridley	Model G	1 3/4
	1 3/4 Greenlee	......	1 3/4
	No. 4 Brown & Sharpe	......	1 7/8
	2 Greenlee	......	2
	2 Gridley	Model RL4	2
	2 Gridley	Model R4	2
	2 Gridley	Model R6	2
	2 Cleveland	Models A, B, & C	2 1/2
	2 × 2 3/4 Cleveland	Model A	3 1/4
	2 1/4 Cleveland	Model A	2 1/2
	2 1/4 × 2 3/4 Cleveland	Model A	3 1/4
	2 1/4 Gridley	Models J, K, & L	2 1/4
	2 1/4 Gridley	Model RL4	2 1/4
	2 1/4 Gridley	Model R4	2 1/4
	2 1/4 Gridley	Model R6	2 1/4
	2 1/4 Greenlee	......	2 1/4
5	No. 6 Brown & Sharpe	......	2 3/8
	No. 208 New Britain	......	2 1/2
	No. 425 New Britain	......	2 1/2
	2 5/8 Gridley	Models G & GA	2 5/8
	2 5/8 Gridley	Model R4	2 5/8
	2 5/8 Gridley	Model R6	2 5/8
	2 3/4 × 3 3/4 Cleveland	Model A	3 1/4
	2 3/4 × 4 Cleveland	Model A	2 3/4
	3 Gridley	Model R4	3
	3 Gridley	Model R6	3
	3 5/16 Gridley	Models G & Ga	3 5/16
	3 5/16 Gridley	Model R4	3 5/16
6	3 1/4 Gridley	Models J, K, & L	3 1/4
	3 1/2 Gridley	Model R4	3 1/2
	4 Gridley	Model R4	4
	4 Cleveland	Model H	4
	4 1/4 Cleveland	Model A	4 1/2
	4 1/2 Cleveland	Model H	4 1/4
	4 1/4 Gridley	Models J, K, & L	4 1/4
	4 1/2 Gridley	Model R4	4 1/2
	5 Gridley	Models J, K, & L	5
	5 Gridley	Model R4	5
	5 1/2 Cleveland	Models A & H	5 1/2
	6 3/4 Cleveland	Model A	6 3/4
	7 3/4 Cleveland	Model A	7 3/4

MACHINERY'S Data Sheet No. 347, New Series, June, 1937

Approved by American Standards Association, November, 1936

CIRCULAR AND DOVETAIL FORMING TOOL BLANKS—2

(See Data Sheet No. 347 for Machine Group Classification)

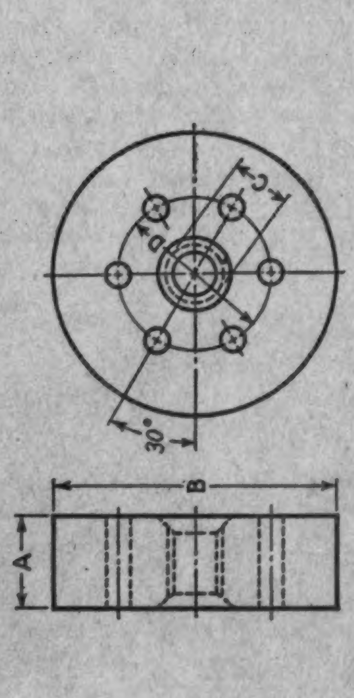


Table 2 Dimensions of Circular Tools With Threaded Holes for Groups 1, 2, and 3

Group Number	Designation[1,2] of Blanks B × A	Width of Blank A	Diam of Blank B	Threaded Mounting[3] Hole C	Adjusting Holes[4] Diam Pin Circle D	Adjusting Holes[4] Diam
1	1 3/4 × 1/4 1 3/4 × 3/8 1 3/4 × 1/2 1 3/4 × 3/4 1 3/4 × 1	1/4 3/8 1/2 3/4 1	1 3/4	3/8–16	No pin holes	
2	2 1/4 × 3/8 2 1/4 × 1/2 2 1/4 × 3/4 2 1/4 × 1 2 1/4 × 1 1/4	3/8 1/2 3/4 1 1 1/4	2 1/4	1/2–13	1 3/8	3/16
3	3 × 1/2 3 × 3/4 3 × 1 3 × 1 1/4 3 × 1 1/2	1/2 3/4 1 1 1/4 1 1/2	3	5/8–12	1 1/2	3/16

All dimensions are given in inches.

Tolerance for dimensions not otherwise specified shall be held to ±0.010.

[1] Circular tool blanks are designated by outside diameter and width of tool blank.

[2] Blanks made of high speed steel shall be stamped H.S.

[3] The threads of the hole "C" shall be made to Class 2 Fit (NC2, ASA B1.1–1935). Both ends of the threaded hole "C" shall be chamfered.

[4] The tolerance on the diameter of the six adjusting holes is plus 0.002 and minus 0.000. The tolerance on the diameter of the pin circle "D" is plus and minus 0.002.

MACHINERY'S Data Sheet No. 348, New Series, June, 1937

Approved by American Standards Association, November, 1936

Paying Investments in New Equipment

Examples of Attractive Investments in Efficient Turret Lathes and Automatics—Second of a Series of Articles from MACHINERY'S Modern Equipment Contest

ALL plant owners and managers seem to believe in the general principle of modernization. The use of more or less obsolete equipment in many plants probably means that the executives responsible for production never have fully convinced themselves that investments in new equipment would result in actual savings of importance. The examples from manufacturing plants found in this and other articles of the Modern Equipment Contest series are intended to stimulate interest in obsolete equipment replacement by presenting dollars-and-cents reasons, based upon actual installations of new equipment.

Modern Turret Lathe Pays Large Dividends

The next example illustrates a method of procedure in estimating savings when a variety of parts must be considered. This often occurs in connection with turret lathes and various other classes of machine tools. The new machine (the ram type universal turret lathe shown in Fig. 1) is to be compared with another turret lathe of different make. The illustration at the head of the page shows the general character of the work handled. Production data for six of these parts showed an average saving in time of 48 per cent.

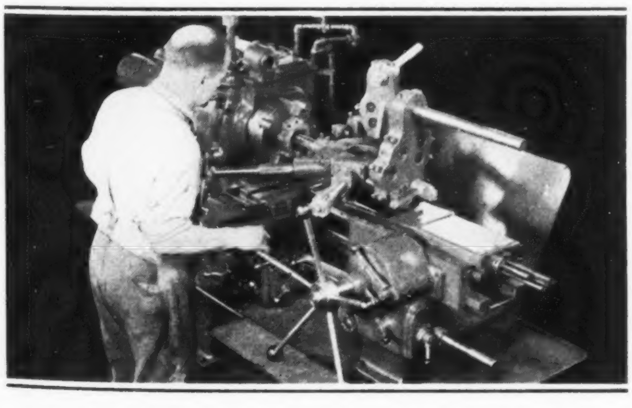


Fig. 1. Modern Turret Lathe which Saves 48 Per Cent of the Time in Machining Parts Like Those Shown at the Top of the Page

This average is based upon a total operating time of 163.4 hours for the new machine, which represents only 6 1/2 per cent of the total annual machine time. Assuming that this total of 163.4 hours is large enough to establish a dependable average, the annual saving would equal about 1200 hours. In the plant where this machine is used, the average cost of machining time is approximately \$1.75 per hour, which includes the operator's rate, machine depreciation, overhead, maintenance, etc. On this basis, the annual saving equivalent to 1200 hours per year equals $1200 \times 1.75 = \$2100$.

The approximate cost of the turret lathe is \$3000, so that the net return on the investment equals $\frac{2100 \times 100}{3000} = 70$ per cent. This saving is based upon a rather small percentage of the total yearly machine time, and also upon the assumption that the machine is fully occupied and the average saving in time of 48 per cent for the six pieces mentioned applies to whatever additional work is done on the machine.

The savings for this machine are attributed to the following features: The versatility of the machine, which adapts it to ordinary small-lot work; quick and easy set-up for different jobs; selective gear transmission with a double multiple-disk clutch between high- and low-speed ranges, which saves time by permitting direct shifting from high to low or vice versa; automatic spindle brake, which stops the spindle quickly without loss of time; central location of all controls; automatic indexing and clamping of hexagon turret; heavy rigid machine design, which permits the use of modern cutting tools and higher cutting speeds. Standard tools were used on two of these jobs which reduced the setting-up time.

Turret Lathe Earns 11 1/2 Per Cent on One Job Requiring about One-Third Its Annual Time

This turret lathe (a high-production type with fixed center turret and a bar feed attachment) replaced an old turret lathe of the same make. The

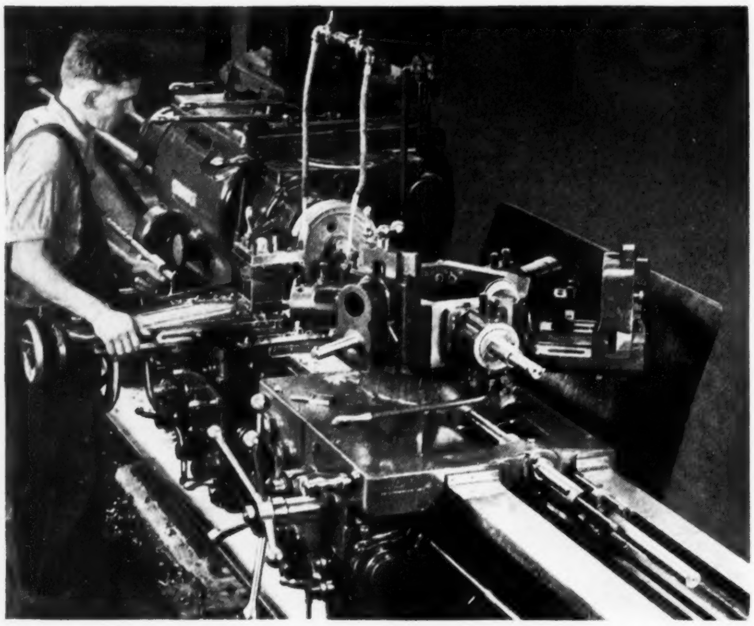


Fig. 2. This Turret Lathe Earns 11 1/2 Per Cent on One Job Requiring About One-third of the Annual Time

job is machining pinion blanks and requires two operations (see Fig. 2). The first operation on the front side of the blank is to center, rough-face, turn, drill, rough-bore, finish-bore, and counterbore; the second operation on the rear side includes drilling, boring, turning, and facing. The illustration shows the machine taking two cuts at one time—turning the outside diameter with the cross-slide and rough-boring with the hexagon turret. The total yearly production of these pinions is 500. The old machine required 2 1/2 hours per gear blank, or 1250 hours per year. The new machine requires 1 3/4 hours per blank, or 875 hours per year. Therefore, the saving in time equals 1250 — 875 = 375 hours.

At the plant where this machine is used, they estimate that $0.90 per hour includes the total cost of overhead per hour of machine time. The operator's rate is $0.78 per hour, making a total of $1.68 per hour for machine time.

This machine is used for machining a great many different parts; however, if it were used only for this one job (which requires 17 1/2 per cent of the total time) and remained idle 82 1/2 per cent of the time, the net annual saving would still equal 375 × 1.68 = $630. This is equivalent to a yield of about 11 1/2 per cent on the investment. (The cost of the machine is approximately $5500.) If this machine could maintain an average saving in time of 30 per cent (amount represented in the foregoing example), then the annual yield on the investment would be 23 per cent.

Among the features of this machine responsible for lower production costs may be mentioned the power rapid traverse of the toolpost carriage in both cross and longitudinal directions, the automatic spindle brake, and the power rapid traverse of the turret carriage in both forward and backward directions.

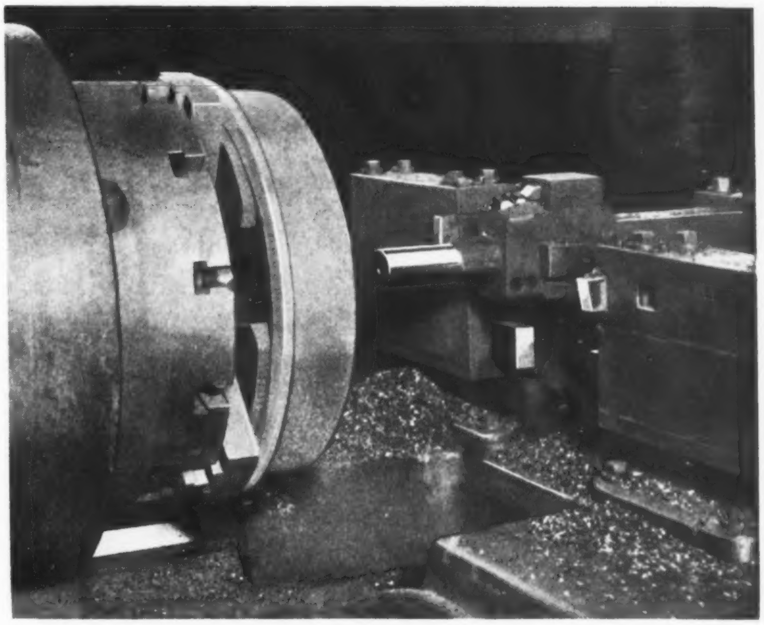
New Turret Lathe Pays for Itself in Less Than One Year

If an old machine is turning out the amount of work required per month or year, many shop owners and plant executives are reluctant to invest several thousand dollars in a modern machine. Evidently, they think about the money to be paid out and fail to make a careful estimate of the money lost by continuing to "get by" with an obsolete machine. The example to follow shows how a new turret lathe of the universal type replaced an older turret lathe of different make and saved about $4800 a year. The new machine cost about $3300. The job (see Fig. 3) is machining rotors for rotary pumps. About 25,000 of these rotors are required annually. With the old machine, the time per rotor was 15.6 minutes, or 0.26 hour; hence it took 6500 hours to produce 25,000.

With the new turret lathe, the time was reduced to 9 minutes per rotor or 0.15 hour, making the total time 25000 × 0.15 = 3750 hours. The time saved per year equals 6500 — 3750 = 2750 hours. The average cost of machining time is approximately $1.75 per hour, including the operator's rate, machine depreciation, overhead, power, maintenance, etc. On this basis, the annual savings

Fig. 3. The Annual Savings Resulting from the Installation of This Turret Lathe are About $4800

Fig. 4. One of a Battery of Eight Automatics which Nearly Paid for Themselves in One Year – First Operation on a Brake-drum



equal 2750 × 1.75 = \$4812, so that the machine pays for itself in nine months, approximately.

A Battery of Eight Automatics Costs a Lot of Money—but the Investment Yields Nearly 100 Per Cent

The job in this example is making brake-drums for trucks in one of the large automotive plants. In 1935, the total production was 213,113 drums, and the data following are based on this production figure. These brake-drums formerly were produced on hand turret lathes. When the turret lathes were replaced by eight "automatics," the total cost of all operations, including assembly on the hub and a final cut over the brake surface on a lathe after the part is mounted on Timken bearing hubs, was reduced from \$0.27 to \$0.10 per drum. This unit reduction makes the yearly saving equal 213,113 × (0.27 — 0.10) = \$36,229. This amount nearly pays for the entire investment in one year.

All tools used are tungsten carbide and are operated at a cutting speed of 250 feet per minute with a 0.020-inch feed, except for the final finish on the lathe, where the same cutting speed is used, but with a feed of 0.010 inch. The maintenance figures are not available, but, according to the management, they are very low, and may be said to be practically negligible.—M. R. CROSSMAN, Gisholt Machine Co., Madison, Wis.

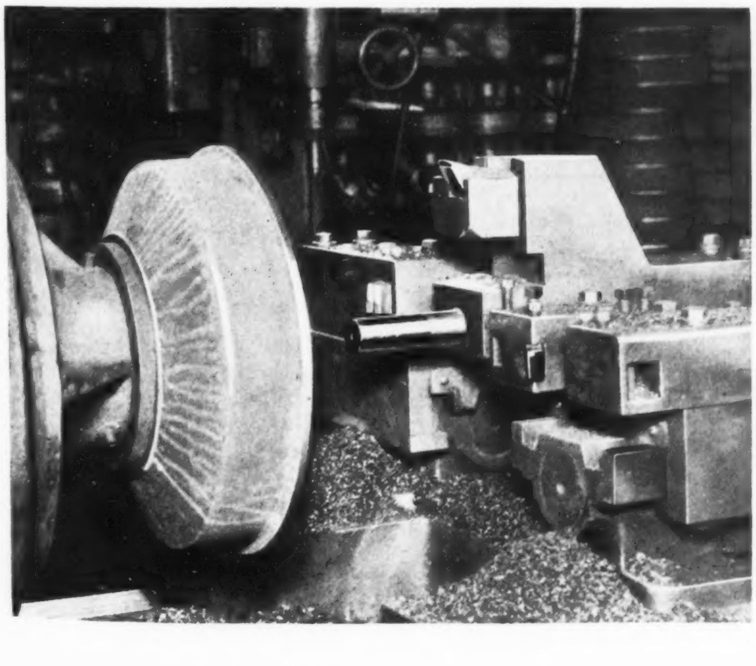


Fig. 5. Second Operation on Brake-drum Machined with Battery of Eight Automatics

German Machinery Industry in 1936

The activity in the German machinery industry continued to increase during 1936. At the end of the year, the machine-building plants of the country operated at over 90 per cent of capacity, according to a report to the Machinery Division of the Department of Commerce from Rolland Welch, assistant American trade commissioner at Berlin.

The turnover of the German machinery industry for the year totaled approximately \$1,200,000,000, and was about equal to that of 1928, which was the best year in the history of German industry. At the close of 1936, orders were booked ahead on an average of from four to five months.

This is the fifth consecutive year of increase of activity in the German machinery industry. While the increase in the first four years of this period was due primarily to rearmament and public construction programs, during the last year foreign sales increased substantially and were largely responsible for the increase in activity, the exports accounting for about 21 per cent of the production. While the exports of machinery from Germany were valued at over \$250,000,000, the imports during the year were valued at approximately \$12,300,000, a marked reduction from 1934, when the imports were valued at \$20,000,000. The German machinery industry employs about 600,000 workers. The work week averaged fifty hours during the year.

The Hydraulic Operation of Machine Tools

Feeding and Traversing Movements of Grinding Machines and Lathes Obtained by Automatically Controlled Hydraulic Units—Second of a Series of Articles

THE control system for an internal grinding machine employing a series of piston-valves is shown in Fig. 5. In this system, used by Fortuna-Werke, the valve *B* receives the pressure oil and is connected to the cylinder for the table traverse. Reversal is controlled by the stops *D* and *E*, the lever *C*, and a gear segment connected to the valve.

To vary the traverse speed, lever *C* is displaced axially by the piston *F*, which normally retains its central position, so that the face *G* of stop *D* strikes the projection on the lever, and, in conjunction with stop *E*, reverses the table. If oil enters the left-hand pipe and moves the piston, the lever projection will engage the face *H* of the stop, so that the table stroke is increased; but if the lever moves to the left, the projection clears stop *D* and the table passes to the right without reversal.

The piston *J* varies the table speed. It is connected to *K*, which, by spring pressure, either maintains or returns *J* to its central position. Pressure oil enters at *L*, and in the position shown, flows to the ports *M* and *N*. The valve *M* varies the table traverse speed, and when closed, a wheel truing speed is obtained by the oil which is compelled to pass through the port *N*.

The slowest table speed is obtained when valve *M* is closed by pressure oil which moves piston *J* to the right. This allows oil to flow into the pipe *Y*, connected with a piston for control of the truing diamond. After this operation, piston *J* returns to its central position, while the diamond control piston is also returned by spring pressure, oil returning through *Y* and then through an opening at the right-hand end of the cylinder in which the piston *J* operates. When piston *J* is moved to the right to permit oil to pass through pipe *P*, the highest table speed is obtained.

The connected pistons *Q* and *R* control the movements of *K* and *F*, oil passing directly to piston *R* through the pipe *S*. The pistons *Q* and *T* are, however, in series, so that oil supplied to piston *T* can only pass through the port *U* to piston *Q* when *T* is in its left-hand position. This movement is controlled by the cam *V* which is connected to *D*, and which strikes the actuating lever.

Pistons *Q* and *R* remain in the position shown, admitting no oil to *F* and *K* until the pawl *A* en-

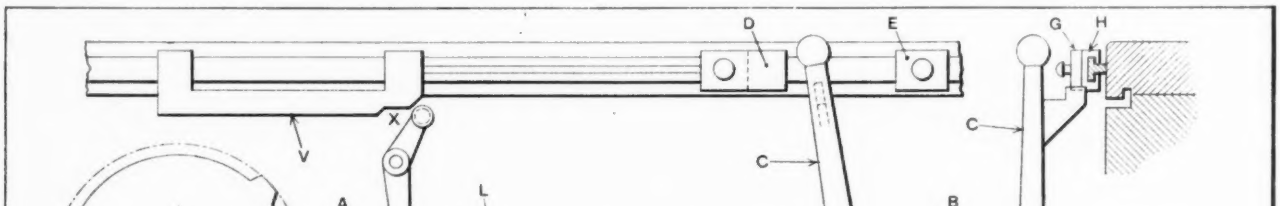


Fig. 5. Hydraulic Control System for Internal Grinding Machine

gages the recess in the cam disk, whereupon pistons Q and R are moved by spring pressure to the left, and oil is admitted to the left-hand ends of the pistons F and K. When the cam projection lifts the pawl, the pistons move to the right and oil is admitted to the right-hand ends of the pistons.

The control piston T is again used to govern the movement of the piston W, which is connected to the bottom pawl. In the position shown, oil is admitted to W when piston T is in the extreme right position. Displacement of piston T to the left stops the oil supply to W, so that by spring pressure it moves to the right until the pawl lever reaches the stop. Piston T does not move far enough to open the port U, so that the transverse feed alone is operated, and for this purpose, the portion X of the cam V is engaged by the crank-lever. The distance of V from the stop D is adjusted so that this position is reached just before reversal occurs.

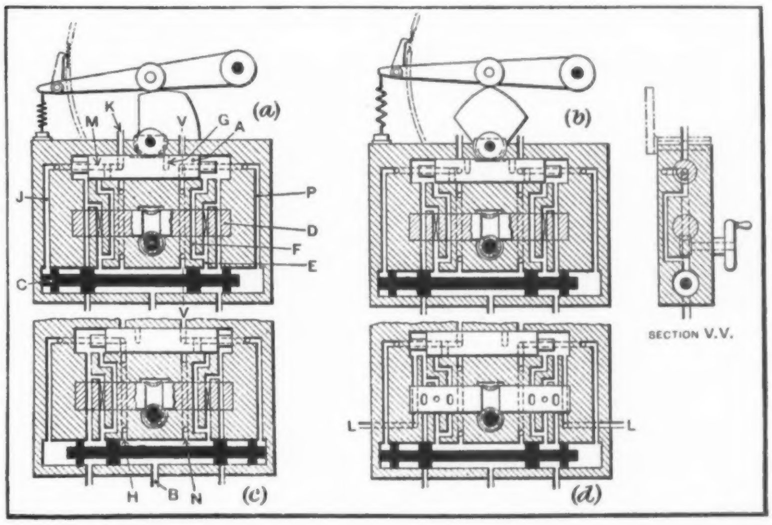


Fig. 6. Hydraulically Operated Ratchet Feed Motion for Approximating Plunge Cut

A hydraulically operated ratchet feed motion that gives either a step-by-step feed or one approximating a plunge-cut motion, patented by the Fortuna-Werke, is shown in Fig. 6. The positions of the members of this device prior to the beginning of a new feeding stroke are shown in view *a*. The view at *b* shows the positions at the end of the stroke. The hydraulic components in the initial position for the next cycle of operations is shown at *c*, and at *d* is shown the hydraulic part of the pawl drive with the plunge-cut arrangement disconnected and the feed dependent upon some reciprocating part.

It will be apparent that movement of piston A will swing the cam between the limits shown and give a feeding movement to the pawl on each stroke of the piston in both directions. Oil is supplied through the port B and operates the double piston C for reversing the piston A, while intermediate between the two, the valve D, operated by a worm and wheel, provides for speed control. The valve ports for throttling are of circular section, but the remaining ducts, which must give a clear oil way under all conditions, are of oval shape.

To obtain the effect of a continuous or plunge-cut feed, the device is actuated in the following manner: From the passages E others branch to F and communicate with the cylinder of piston A, which opens them as it passes from end to end. With the opening of these branch passages, the throttling effect is nullified and the piston is driven to its end position at great speed, so that the pause between the feed strokes of the pawl is almost imperceptible and a plunge cut is closely approximated.

On reaching its end position, piston A automatically initiates its reversal by the four grooves G, each extending over one-fourth of the piston periphery and making connections as follows: (1) From port B, passage N, and the groove leading to passage P, oil pushes the pilot piston C to the left when the piston A has reached its left-hand position; (2) from the chamber of piston C, through J and groove M to the discharge passage K, so that the movement of this piston is possible; (3) as in (1) but for right-hand displacement of piston C for opposite stroke, by way of passage H; (4) as in (2) but for oil discharge from the opposite end of piston C to the outlet passage V.

In order to give a sudden traverse to piston C and avoid unstable conditions in the system, the grooves in piston A admit pressure oil to piston C before ports K are opened, so that a back pressure is built up in front of this piston, which, on being released, causes it to be moved rapidly into its new position.

For the ordinary feeding motion, a change-over device is fitted so that the plunge-cut feed is disconnected, and conduits L are used alternatively for the admission and discharge of oil, so that piston A actuates the ratchet motion in unison with the movements of the reciprocating table.

Hydraulic Valve Gear Designed for Accurate Reversal

For accurate reversal, as is required in machining up to a shoulder, it is customary to use two controlling pistons, although springs have sometimes been used to overcome the dead point. A satisfactory solution of this problem, which makes use of a single valve of the rotary and piston type, in which either movement may be obtained from the reciprocating table and thus actuate the other to supply oil to the main table cylinder, has been devised by Fritz Werner, of Berlin, Germany. Various views of this device are shown in Fig. 7, in which A represents the table piston and B the control valve. In views 1, 2, and 3, the piston moves to the left while the valve is held in its right-hand position. Oil enters through the duct C and flows through the

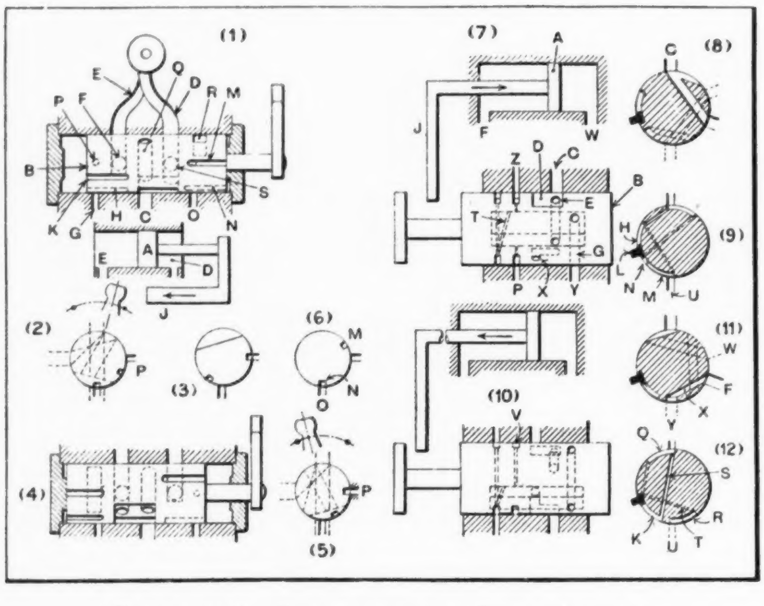


Fig. 7. Valve Gear Arranged to Permit Accurate Stroke Reversal

connecting duct to the port *D* and the right-hand end of the cylinder. It returns by port *E*, the connecting recess in the valve, and duct *F* to the exhaust. At the same time, the oil can pass to the left of the piston through the fixed duct *G* and the auxiliary duct *H* in the valve, while similar ducts connect the space at the right-hand side of the exhaust.

Before the main piston reaches the left-hand end, the table, by means of the stop *J* and the valve lever, rotates the valve. This closes the duct *H* while the duct *K* passes in front of outlet *P*, view 5. The duct *M* is also closed while the duct *N* passes in front of the inlet aperture *O*, view 6. Thus the oil flows through the ducts *O* and *N* to the right of the valve and forces it to the left. At the same time, the left-hand side of the valve is free from load, being connected with the outlet through *K* and *P*. In this position, the main ducts are reversed, the oil flowing through *C*, *Q*, and *E* to the main cylinder and back from the opposite end through *D*, *R*, and *S*. As shown in views 2 and 5, the ducts are staggered in relation to each other to the extent of the angle described by the stop-lever.

A position is shown in views 7, 8, and 9 where the piston *A* moves to the right, while the valve *B* remains in its left-hand position. Pressure oil enters at *C* and flows along *D*, *E*, and the duct *F* to the left-hand end of piston *A*, the exhaust oil returning from the opposite end to the duct *G* and back to the tank. At the same time, the oil is admitted to the sector chamber *H*, view 9, through the duct *Z* in the housing and piston, and thus turns the valve clockwise into the position shown at 9. Simultaneously, the oil is forced out of the sector chamber *K* situated on the other side of the distance piece *L*, through the ducts *M* and *N* and the outlet *U*. The remaining ducts in views 7 to 9 are closed off.

Before piston *A* reaches the right-hand end, stop *J* displaces valve *B*, closing ducts *Z* and *M*, and opening *Q* and *R*, view 10, so that oil flows from *Z* through *Q* and *S* into the sector chamber *K*, and, at the same time, turns the valve counter-clockwise, view 12. The other side of the distance piece *L* is free from load, because it is connected with the outlet by ducts *T*, *R*, and *U*, and the main ducts are reversed, so that oil flows through *V*, *D*, *E*, and *W*, view 11, to the piston, while exhaust oil returns by way of *F*, *X*, and *Y*, view 11, to the tank.

A hydraulic device designed to eliminate any flexible or moving connections between the pump and feed cylinder, which has been patented by Robert Wolfle, Cologne, Germany, is shown in Fig. 8.

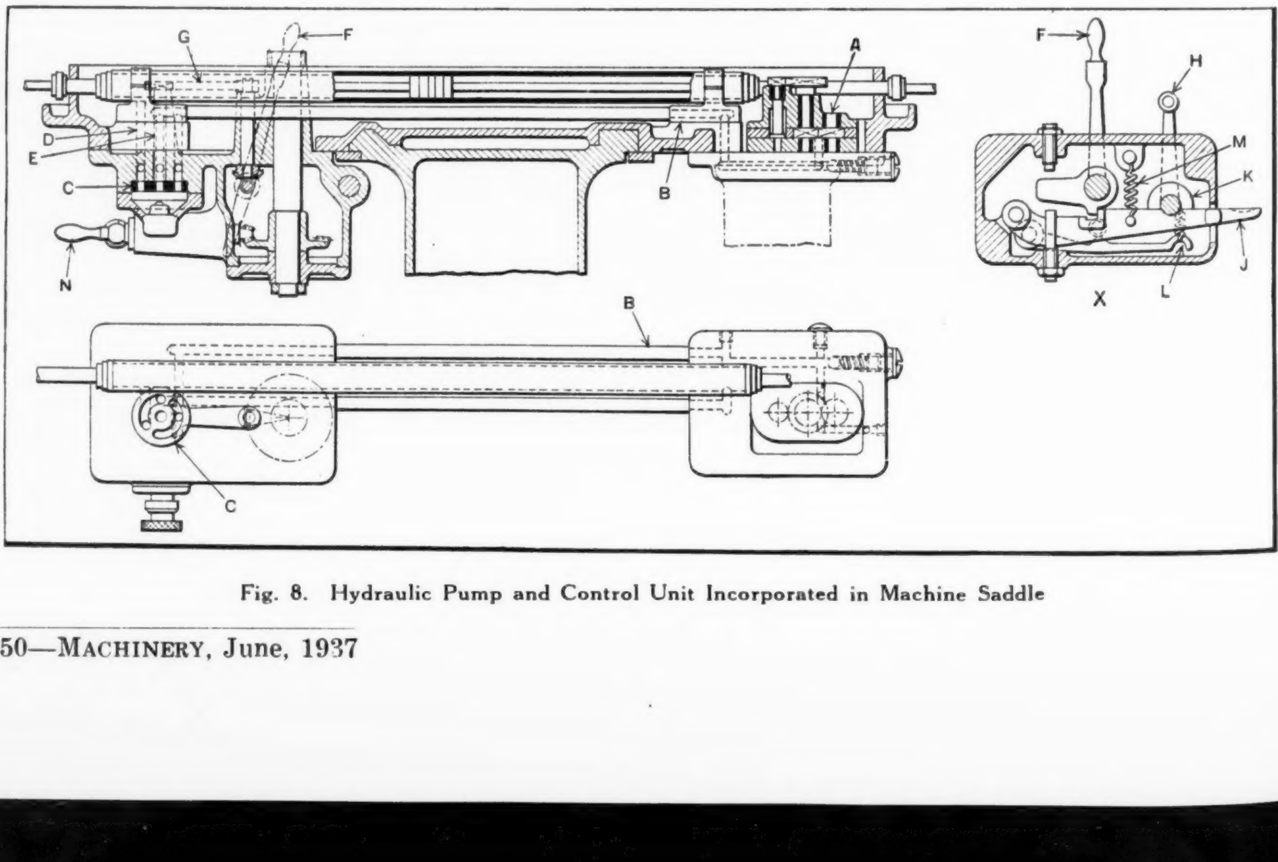


Fig. 8. Hydraulic Pump and Control Unit Incorporated in Machine Saddle

The entire hydraulic gear is arranged as a unit in a saddle constructed as the oil tank; consequently, all leakage is avoided. This unit can be readily applied to an existing machine.

The pump *A* is secured below the right-hand end of the saddle and forces oil through the supply pipe *B* to the control disk *C* in the housing beneath the left-hand end of the saddle. The control disk allows the passage of oil through the duct *D* for traversing the table piston to the right or through *E* for the opposite traverse. Adjustable stops on the table actuate the reverse lever *F* which operates bevel gears, gear segment *G*, and a mating pinion at the top of the control shaft, to give a reverse motion to the table.

For a single table stroke, the lever *H*, which has previously depressed the stop-lever *J* by means of the eccentric *K* and locked it in this position so that the lever *F* could reciprocate, is raised to the position shown at *X*. A projection on lever *J* comes in contact with a stop on lever *F*, which is then held in the neutral position, with the table stationary. For a single traverse, lever *J* is normally depressed for a short period, so as to release lever *F*, which is rotated by the spring-operated lever *L* by means of its cam surface and a roller on the end of the reverse lever *F*.

A projection on lever *F* and two adjustable screw stops assure that it is moved the correct distance for properly connecting the control disk and the passages leading to the cylinder. After the table has made a single stroke, the spring *M* again raises lever *J* so that the projection engages the stop on lever *F*, and the table remains stationary. The table can be hand-operated by the lever *N* and connecting gears, while the control disk can be similarly actuated by an extension on the reverse lever, located on the opposite side of the machine.

A Training Course in the Marketing of Industrial Products

THE only training course in the marketing of industrial products conducted through the auspices of a university is, as far as is known, the course conducted at the University of Pittsburgh under the leadership of Bernard Lester, industrial sales executive of the Westinghouse Electric & Mfg. Co., and lecturer at the University of Pittsburgh. The group of young men taking the course as part of the University of Pittsburgh–Westinghouse graduate study program is made up of twenty-five men selected by their department heads. Since this training course is a new departure in education, it is attracting wide attention and the results are being watched with interest by sales executives.

According to Mr. Lester, the days of the breezy, smart salesman have passed. Engineering selling today is a serious matter; and although personality in the individual adds much to his success, the man who will succeed best is the one who knows the technique of the product to be sold and the character of the market to be covered, and, above all, who is capable of understanding his customers' problems and their solution. Such men must be developed through training.

Bernard Lester, Westinghouse Industrial Sales Executive, Who Conducts the Industrial Marketing Course at the University of Pittsburgh

In the course, the students obtain their fundamental knowledge from a study of Mr. Lester's recent book "Marketing Industrial Equipment," and from assignments in current trade and engineering literature. In order to apply the principles, the student, during the first half of the course, makes a comprehensive survey of a particular industry representing a market for industrial equipment. During the latter half of the course, each student considers himself a sales manager of a company making a specific line of machine equipment or supplies. He outlines a complete selling program and a plan of distribution. This plan is complete as to sales methods, avenues of distribution, sales force required, sales promotion and advertising plans, and warehousing and servicing facilities. It includes a budget covering sales volume and sales expense.

Mr. Lester states that many young technical graduates have told him that their conventional engineering training has left them entirely at sea as to the relationship between the product, the market, and an organized method of reaching the customer. Industries dealing with technical products and service are, however, looking for men well grounded not only in technical principles, but also in the principles of distribution.

* * *

According to *Industrial Britain*, the United Kingdom has increased its industrial activity from 1930 to 1936 at a greater ratio than any other industrial nation, with the exception, perhaps, of Japan.

Engineering News Flashes

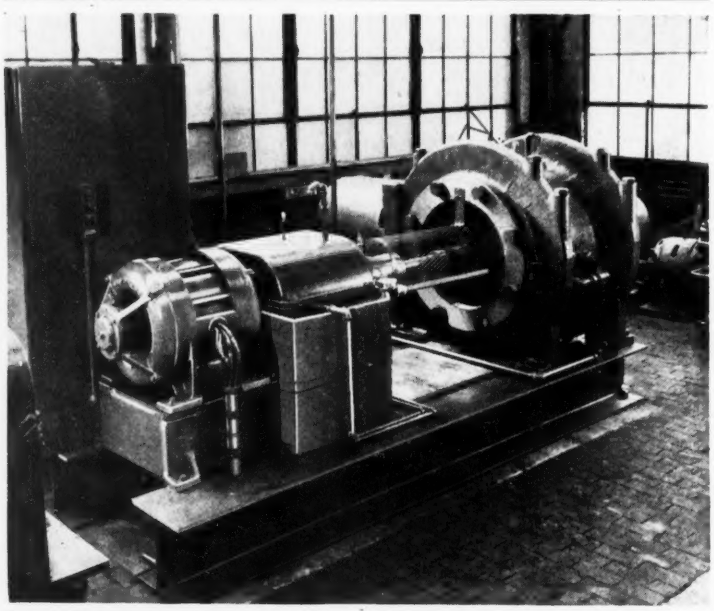
The World Over

Tubing 0.005 Inch in Diameter

Pure nickel tubing has been produced in such small sizes that, according to the International Nickel Co., five miles of it weigh less than one pound. This tubing has an outside diameter of 0.005 inch. The thickness of its walls is only 0.0008 inch. Its principal use is for hypodermic needles, where obviously its non-corrosive quality is of value.

Bearing-Testing Machine of Large Dimensions

What is possibly the largest bearing-testing machine in the world has recently been designed by the Timken Roller Bearing Co., Canton, Ohio. In it single- and double-row bearings up to 24 inches outside diameter can be tested under both radial and thrust loads. Radial loads up to 500,000 pounds and thrust loads up to 200,000 pounds can be applied to the bearings under test by means of hydraulic rams. Provision is made for filtering and cooling the lubricant. An oil-pump circulates the oil through a cooler and delivers it to the housing, while a second pump draws the lubricant from the housing to the oil tank beneath the machine. A 75-horsepower two-speed motor drives the bearings, through a speed-changing transmission, at speeds varying from 27 to 1000 revolutions per minute. A torque device installed between the transmission and the test spindle indicates the power loss in driving the bearings.



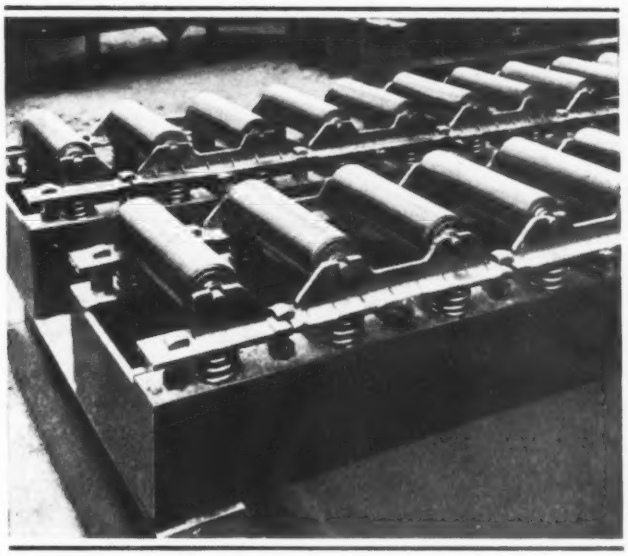
A Bearing-testing Machine of Large Capacity Designed by the Timken Roller Bearing Co., by Means of which Radial Loads up to 500,000 Pounds and Thrust Loads up to 200,000 Pounds can be Applied to Bearings by Means of Hydraulic Rams

A 650-Room Hotel Air-Conditioned

The advance of air-conditioning is exemplified by the fact that the Statler Hotel in St. Louis has installed air-conditioning in every guest room, as well as in all restaurants and all other public rooms. The type of air-conditioning installed permits the guest to "make his own weather." The regulator available in every room permits the temperature of the room to be controlled in the hottest weather of summer, as well as in winter.

The Steam Train Holds Its Own with the Diesel

Working along the lines of further developing steam locomotive transportation, one of the British railroads has inaugurated a 6 1/2-hour service between London and Edinburgh. This means an average speed of approximately sixty-three miles an hour for the entire distance, and is equivalent



A Newly Developed Shock-absorbing Roller Conveyer where Spring-mounted Roller Supports Permit Each Roller to Take Its Proportionate Share of the Load. An Additional Advantage is that when a Heavy Load is Suddenly Dropped on the Conveyer, the Shock on the Rollers and Bearings is Greatly Reduced

to train service that would cover the distance between New York and Buffalo in about seven hours, as compared to eight hours and ten minutes, the schedule time of the Empire State Express.

Producing Soap from Coal

It sounds paradoxical, but soap is actually being produced from coal—that is, paraffin obtained from the distillation of brown-coal tar is being made to yield a white fatty acid that lends itself to saponification. The new process, according to *Compressed Air Magazine,* is looked upon as of especial importance in Germany, because of the practically unlimited resources of brown coal available there, coupled with a shortage of soap materials.

Shock-Absorbing Roller Conveyers

In the past, roller conveyers have always been built with solid mountings. These are perfectly satisfactory for ordinary conditions when comparatively small objects are being conveyed. During the last decade, however, roller conveyers have been applied in industrial plants for transporting large objects such as molds, castings, etc. In one plant, racks 20 feet long are placed on a roller conveyer, and on these racks, in turn, are placed the cast side frames for railroad car trucks. The combined weight of the rack and the side frames is as much as 12,000 pounds. Piles of sheet steel weighing up to 40,000 pounds are being conveyed by similar means from one point of operation to another.

Such loads place new demands on roller conveyers. In one instance, each roller, if carrying its proportionate share of the weight, would sustain 811 pounds. In actual tests, it was found, however, that due to distortions in the surface of the load resting on the rollers, some of the rollers support over 4000 pounds. Assume that these rollers have a rated load-carrying capacity of 1000 pounds each. Obviously, they are being greatly overloaded. To meet this difficulty, the Mathews Conveyer Co., Ellwood City, Pa., has developed what is known as a shock-absorbing resiliently mounted roller conveyer, as shown in the accompanying illustration. Since here the roller supports rest upon springs, it is obvious that the loads carried by each roller will be equalized. Another advantage is that if a heavy load is dropped on the roller conveyer, as is frequently the case, the tremendous shock that solidly mounted rollers would have to stand is cushioned by the spring construction.

Exhibition of Chinese Castings Over a Thousand Years Old

At the American Foundrymen's Association convention in Milwaukee early in May an array of ancient Chinese castings was exhibited through the courtesy of Thomas T. Read, of the School of Mines, Columbia University, New York. The largest of these castings was 30 inches high. The oldest one was made in the year 458 A.D. and the most recent one exhibited was molded in 1093. These castings recently arrived in the United States and were publicly exhibited for the first time at this convention.

Railroad Rails 120 Feet Long

What are believed to be the longest rails ever used on regular railroad main lines anywhere in the world have been rolled by the Skinningrove Iron Co. in Great Britain and laid on the London & North Eastern Railway Co.'s main line. These rails are 120 feet in length. With longer rails, it is believed that smoother running of trains will be obtained by reducing the number of joints. It is also claimed that track maintenance work will be reduced.

EDITORIAL COMMENT

Depreciation Reserves Should be "Replacement" Reserves

Definite policies in replacing obsolete machine equipment are being followed by several machine-building concerns. Some of these policies have been outlined in past issues of MACHINERY. One large machinery builder uses, annually, approximately the entire amount charged to depreciation—that is, 10 per cent of the cost value of his equipment—for buying new equipment. Another replaces his equipment at the rate of nearly 15 per cent a year. Obviously, the equipment of these firms is always in good condition, capable of producing at low costs. As a matter of fact, these firms have been unusually successful.

One of the difficulties encountered in adopting a program of this kind is that, generally, depreciation reserves are not actually available in cash. If the amounts that the machinery is depreciated each year were actually set aside for replacement purposes, it would be easy to apply these reserves to the buying of new equipment as machines become obsolete.

One manufacturer suggests that against every job should be charged not only labor and material, but depreciation, and that just as labor and material have to be paid for in cash, so should depreciation be paid for in cash, and the amount set aside definitely for replacement purposes. Any concern following that policy would at least be likely to know its costs better than those who do not; and, furthermore, since ready cash would be available for the replacement of old equipment, such replacements could be more easily effected. Again, since the shop would constantly be well equipped, it would stand a much better chance in competition with other less well equipped plants.

Depreciation reserves that are merely bookkeeping figures, permitting a deduction for income tax purposes, are not of much value in keeping a machine shop up to date. If these reserves are in actual cash, it is more likely that they will be used for the purpose for which they are intended.

Research in Industry, the Basis of Modern Comforts of Life

Research in industry, which is possible only if someone is willing to pay the cost—that is, to provide the capital—has brought great returns to investors. But what about the benefits that have been enjoyed by the users of industry's products? What if nobody had been willing to spend his money for research? Where would the electric light be? Where the cheap power now available for home use? Where the automobile, the radio, and all the other modern developments that add so much to the comfort and recreation of mankind? Where would the developments in medical science be, which are so largely dependent upon the instruments and materials provided by the engineer and the chemist? In these days, when it is the fashion to heap abuse on industry, the great benefits that industry has conferred upon all of us are forgotten.

Are We Overlooking an Important Phase in Standardization?

Some time ago we quoted on this page the old saying, "It isn't enough to convince a man that you are right; you must get him to act on his conviction." This applies with especial force to engineering standardization work. Much commendable effort has been spent in the standardization of equipment, methods, and products. Users and makers have cooperated in bringing about the adoption of standards acceptable to both groups.

The formulating and approving of standards is well organized; but after a standard has been duly adopted, the work of introducing it as the universal standard of industry is less well developed and organized. The engineering and trade journals are ready to be of service to the standardization committees in calling attention to newly adopted standards and in presenting the essential facts pertaining to their adoption.

The important work of a standardization committee is not finished when an acceptable standard has been agreed upon. Part of the committee's work should consist in the promotion of the use of the standard. It should be given as wide publicity as possible, and the importance of the standard to industry should be emphasized. An adopted standard, to be useful, must be an applied standard.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Mechanism for Starting, Stopping, Changing Speed, and Reversing Output Shaft

By M. JACKER

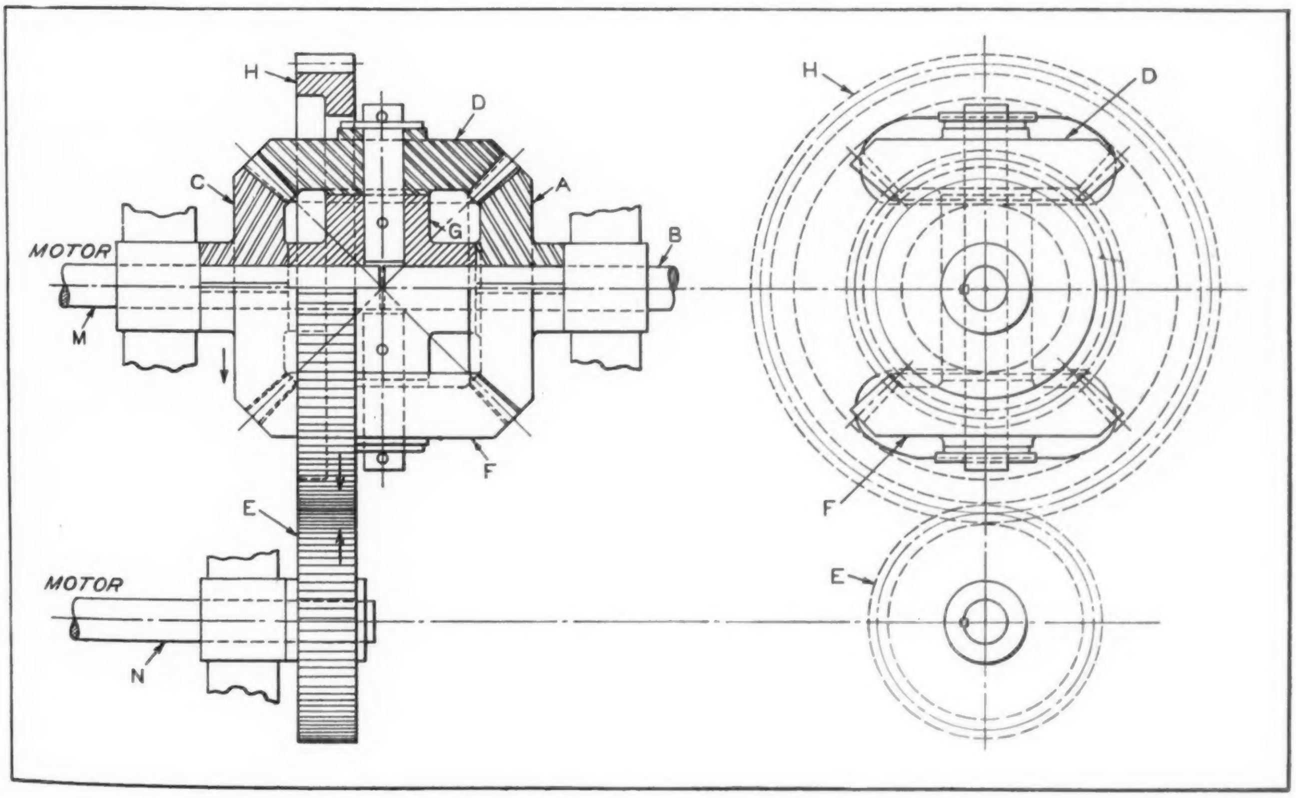
A mechanism with two driving motors which permits starting, stopping, changing speed, and reversing the output shaft without stopping the motors is shown in the accompanying illustration. This control over the driven shaft is obtained by means of differential gearing without the use of friction clutches, gear shifts, or other well-known speed-changing and stopping devices, and is accomplished by simply changing the speeds of the two driving motors.

Each of the four bevel gears *A*, *C*, *D*, and *F* have the same number of teeth. Gear *C* is keyed to the motor shaft *M*, and gear *A* is keyed to the output shaft *B*. Both of these shafts extend to the center of the cross-piece *G*, which is cast integral with the spur gear *H*. The cross-piece provides a working bearing for gear *H*, as well as a support for the shafts of bevel gears *D* and *F*. Pinion *E* is keyed to the motor shaft *N*. The gears *E* and *H* are in the ratio of 2 to 1. The arrows on the faces of these gears indicate the direction of rotation.

Four tables of speeds, not shown, are used in operating the mechanism. These tables indicate the speed and direction of rotation of the gears *E*, *C*, *H* and *A*. The tables show that *E*, *C*, and *H* revolve in one direction continuously. The tables give the speed at which each motor must be operated to give the output shaft *B* any forward or reverse speed from 0 to 320 revolutions per minute in steps of 20 revolutions per minute, with the motor speeds ranging from 340 to 660 revolutions per minute. Of course these speeds may be increased.

With both motors operating at the same speed, bevel gear *A* and output shaft *B* remain stationary. In order to rotate the output shaft, the speed of one of the motors must be increased or decreased, depending on the direction in which the driven shaft is to be rotated.

To put the mechanism in operation, the motors are started simultaneously and their speed advanced in synchronism to 500 revolutions per min-



Mechanism for Controlling Driven Shaft by Changing Speeds of Two Driving Motors

ute, for example, without imparting motion to shaft *B*. Then, on decreasing the speed of the motor connected to shaft *N* 10 revolutions per minute, and increasing the speed of the motor connected to shaft *M* 10 revolutions per minute, for example, the output shaft *B* will be driven at a speed of 20 revolutions per minute in the same direction as shaft *N*.

Or, similarly, if the speed of the motor connected to shaft *M* only is increased, it will cause an equal ratio of speed increase in the output shaft *B*, but will make it revolve in the opposite direction to that of the motor shaft *M*, and if the speed of the motor shaft *N* only is increased, it will cause a like ratio of increase in the output shaft *B*, but in the opposite direction to that of the motor shaft *N*. While the tables show the speeds of the driven shaft obtained by increasing or decreasing the speed of the motors by steps of 20 revolutions per minute, the changes in speed are actually stepless and accomplished by a smooth acceleration or deceleration.

Variable-Speed Drive with Interchangeable Scroll for Controlling Speed Variations

By WILLIAM SHAW

A mechanism for varying the speed of spinning machine bobbins driven from a constant-speed shaft and for varying the speeds of different driven members of other textile machines, such as pickers and winding machines, is shown in the accompanying illustration. The main driving shaft of the mechanism is shown at *A*. The gear *B*, mounted on shaft *A*, drives the spindles of the spinning machine at a uniform speed. Mounted on the drive-shaft *A* is a differential sleeve *C* to which is keyed a spur gear *D* which is utilized for driving the bobbins. The sleeve *C* can be rotated about shaft *A*, the speed being varied to suit the bobbin-winding requirements. The object in varying the speed of gear *D* is to compensate for the difference in diameter of the bobbins as the winding proceeds. The variations in the speed of gear *D* necessary to meet different winding requirements are controlled by the shape of the scroll *V*.

Gears *B* and *D* have the same number of teeth. The inner end of sleeve *C* has a cylindrical-shaped housing *E* with an internal ring gear *F*, which, in this case, has 48 teeth. The cross-piece *G* is keyed to the main drive-shaft *A* within the cylindrical housing and has its opposite terminals provided with studs *H* on which are mounted two gears *I* and two gears *J*. The gears *I* have 16 teeth, while the gears *J* have 30 teeth each.

The gears *I* mesh with the internal ring gear *F*, while the gears *J* mesh with a gear *K* having 18 teeth. Gear *K* is integral with a second differential sleeve *L* which is free to rotate on the drive-shaft *A*. Splined to the second differential sleeve *L* is a sliding differential sleeve *M* which has secured to its inner end a large spur gear *N* meshing with a relatively small pinion *O*. Pinion *O* is driven by the leather-faced disk *P* secured to the end of shaft *A*. Disk *P* drives pinion *O* through the small hardened steel friction wheel *Q*, gears *R*, and the chain and sprocket drive, as shown. The gear *R* on the shaft with wheel *Q* has a driving key which slides in the keyway *Z*.

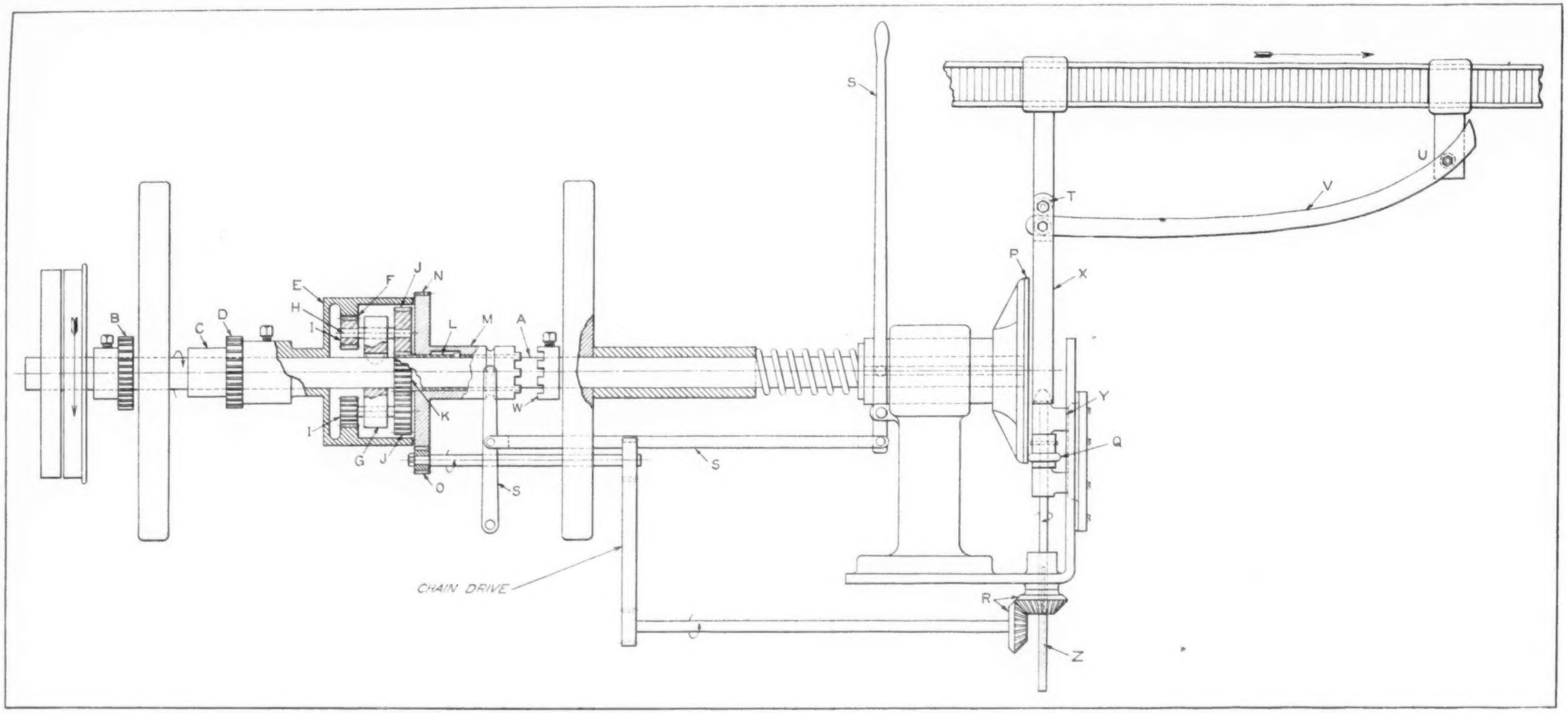
The differential sleeve *M* has clutch teeth designed to engage the teeth *W* of a non-sliding clutch section secured to the main drive-shaft *A*. The sliding sleeve *M* can be engaged or disengaged by means of the links and lever *S*. When the teeth of sleeve *M* are brought into mesh with the teeth *W*, gear *N* will be moved out of engagement with pinion *O*. When gear *N* is held stationary in the position shown, the speed of the bobbin-driving gear *D* will be increased one revolution for every five revolutions of the driving shaft *A*.

The operation of the mechanism is as follows: The cross-piece *G*, being keyed to drive-shaft *A*, causes the gears *J* to revolve about gear *K*. Assuming that gear *K* is standing still, gear *D* will gain one-fifth of a revolution; thus the bobbins are given their highest speed when gear *K* is held stationary. When the winding operation is started, the small friction wheel *Q* is located at the center of the friction disk *P*. With wheel *Q* in this position, the bobbins are driven at their highest speed, as required at the beginning of the winding operation. Shaft *A* drives both the bobbins and the spindles at all times, and the small friction wheel *Q* and disk *P* do no driving, but simply act as a governor.

As gears *J* rotate about gear *K* when the latter gear is at rest, it follows that housing *E* or gear *D* is driven at its highest speed in the same direction as driving shaft *A* when gear *K* is held stationary. Before the bobbin-winding operation is started, the rack is wound, bringing the small roller *T* to the point *U* on the scroll *V*. At this point, roller *Q* is positioned almost at the center of disk *P*. The rack then moves laterally in the direction indicated by the arrow. The rack is generally operated by a ratchet gear and pawls, but can be operated by any other means. The bar *X* is rigidly secured to the slide or block *Y*.

As the small roller *T* follows down the curve of scroll *V* at every movement of the rack, the small roller *Q* drops or moves away from the center of the disk toward its periphery. As the winding continues, each movement of the rack increases the speed of the small roller *Q*, which results in reducing the speed of the bobbins. From this it will be seen that any desired change in the speed of the bobbins driven by gear *D* is made possible by changing the curve on the scroll *V*, so that the roller *Q* will be driven faster or slower, as required, through the movement imparted to slide *Y* by the cam *V* through bar *X*.

It should be clear from the preceding description that the greatest speed of gear *D* is obtained when gear *K* is held stationary, and that, as the



Mechanism by which Gear B is Rotated at a Constant Speed while Gear D is Rotated at a Variable Speed Controlled by the Shape of Scroll V

roller *Q* on the disk allows gear *K* to revolve in the same direction as the driving shaft, the faster gear *K* revolves the slower gear *D* will turn. If the small roller *Q* is driven at a rate which allows gear *K* to revolve as fast as the driving shaft *A*, no winding or rotating movement of gear *D* takes place. When gear *N* is disengaged from pinion *O* and connection is made between the sliding differential sleeve *M* and the non-sliding clutch section *W*, the whole differential mechanism is locked, so that gears *B* and *D* revolve at the same speed.

The Russian Machine Tool Industry in 1936

By the end of 1932, the domestic production of machine tools in Russia met about 25 per cent of Russia's machine tool requirements. In February, 1937, from 80 to 85 per cent of the Russian demand was met by Russian-built machine tools. It has been estimated that the value of the machine tools built in 1936 was approximately $160,000,000. In all, 29,600 machines were built in 300 different types and sizes. The output consisted, among other machines, of 8000 lathes, 2500 milling machines, 500 gear-cutting machines, nearly 2000 grinding machines, and 3600 drilling machines. About 600 machines are listed as "automatic and semi-automatic machine tools. There are eighteen machine tool plants under the "Central Administration of the Machine Tool Building Industry of the Commissariat for Heavy Industry." [From *World Machinery News*, published by the Machinery Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.]

Republic Steel Corporation

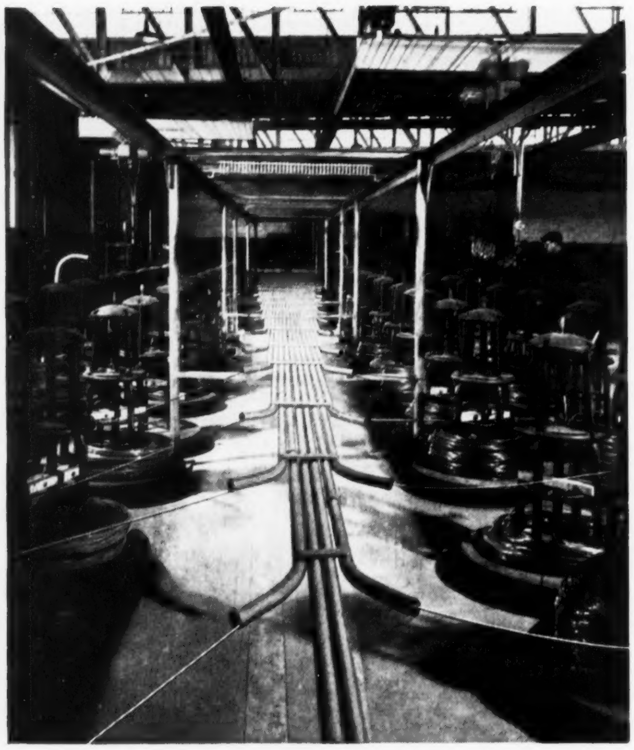


Fig. 1. Forty Strands of Wire Travel Simultaneously through Sheaves of Metal Tubing into the Lead Annealing Furnace at the Beginning of the Electro-galvanizing Line, in the New Wire Mill of the Republic Steel Corporation. As the Wires Leave the Annealing Furnace, They Pass Overhead to a Battery of Cleaning Tanks and then on through the Electro-galvanizing Unit

HIGH-SPEED mechanical work-handling equipment, automatic electrical devices which insure uniformity of the products, and chemical apparatus of latest design have been utilized to expedite continuous production in the new wire mill of the Republic Steel Corporation, which was formally opened on April 27 at South Chicago, Ill. This plant was erected for the manufacture of plain and electrically zinc-coated wire, barb wire, woven wire fence, and nails. As much as 578 miles of fence wire, alone, electro-galvanized with twenty-seven layers of zinc, is produced in one day.

Coils of steel to be drawn are thoroughly cleaned when they come from the storage yard by passing them through acid, rinse, sull and lime tanks, after which they are conveyed through gas-fired ovens, automatically held at the desired temperature. From these ovens, the steel coils are delivered to the drawing machines by batteries of electric trucks, loaded as shown in Fig. 2. There are eleven high-speed machines in the wire-drawing department, some of which draw the wire once or twice, and others as many as six times. The five-hole machines are capable of drawing No. 13 to 16 gage wire from No. 5 rod at speeds ranging from 1000 to 1400 feet a minute. Wire from No. 10 1/2 gage to 3 1/2-inch diameter is drawn by the double-deck machines at speeds ranging from 290 to 860 feet per minute. Water-cooled tungsten-carbide dies are used on all of these machines. Continuous drawing is made possible by welding successive coils of wire end to end.

The driving equipment for the wire-drawing machines and the electrical control apparatus are installed in tunnels under the floor, so as to leave the

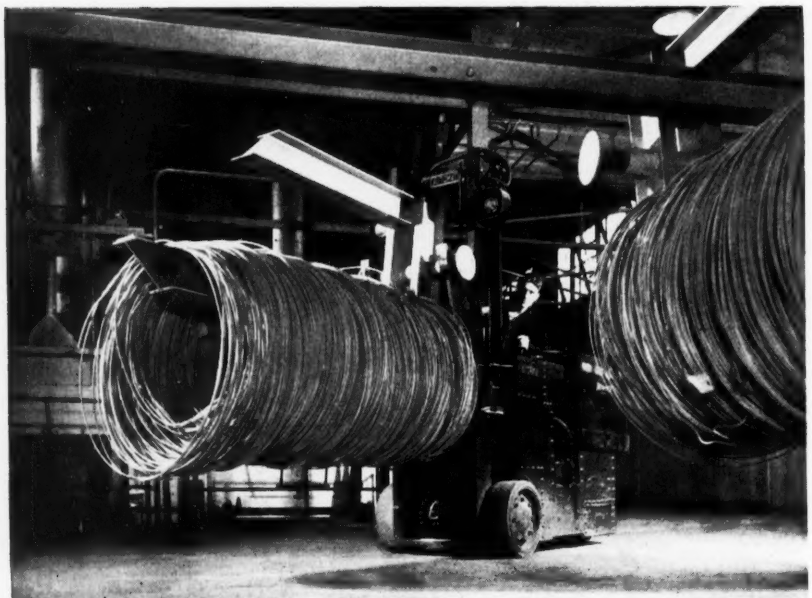


Fig. 2. Electric Lift Trucks Carry the 3600-pound Coils of Wire from the Automatic Baking Ovens to the Wire-drawing Department. Here the Coils are Welded End to End to Permit Continuous Operation of the Wire-drawing Machines at Speeds up to 1400 Feet a Minute

Operates New Wire Mill

aisles between the machines clear for handling materials and products. The tunnels also facilitate the oiling of lineshafts and the servicing of belts, and have the advantage of eliminating shadows from overhead belts and shafts. All together, there are 1200 lineal feet of these sub-floor tunnels.

One of the outstanding features of the plant is the electro-galvanizing line, which is almost 500 feet long. Forty strands of wire pass continuously through the 43,000-gallon electrolytic bath at speeds ranging from 35 to 70 feet a minute, depending upon the diameter of the wire and the coating to be applied. In Fig. 1, these wire strands may be seen being pulled through sheaves of metal tubing into the lead annealing furnace at the beginning of the zinc-coating operation, while Fig. 3 shows the wire emerging from the electro-galvanizing tank. Between the annealing and the galvanizing, these wire strands are passed through a series of electric cleaning and pickling tanks.

There are fifty-six nail-making machines in the department illustrated in Fig. 4. These machines are all belt-driven from lineshafts, also located in tunnels underneath the main aisles, each lineshaft driving fourteen machines. The nails are discharged into inspection pans which are dumped into carts having a capacity of 1000 pounds each. These carts are transferred from overhead cranes to tumbling machines, each of which has a capacity of 40 kegs of nails per charge.

Another unusual feature of this plant is the use for the first time by an American steel plant of direct-current electricity furnished by a mercury arc rectifier with automatic voltage control accomplished through electrically energized grids.

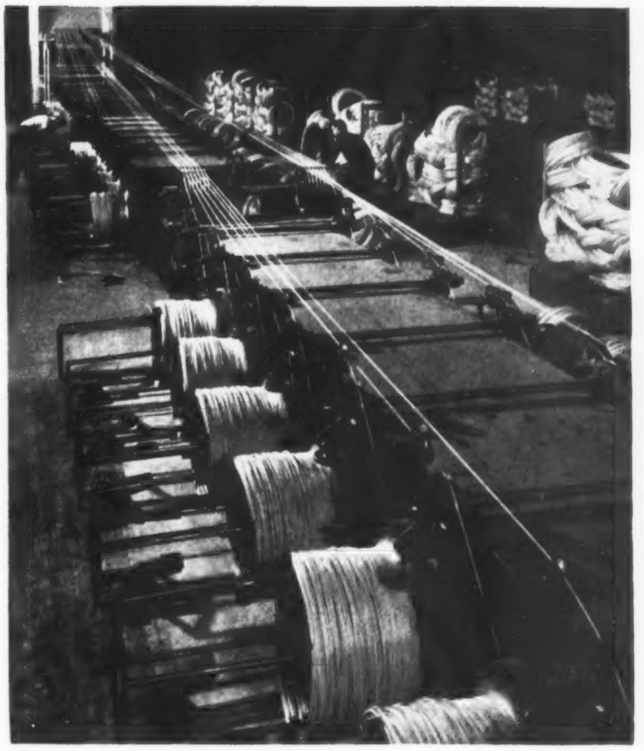
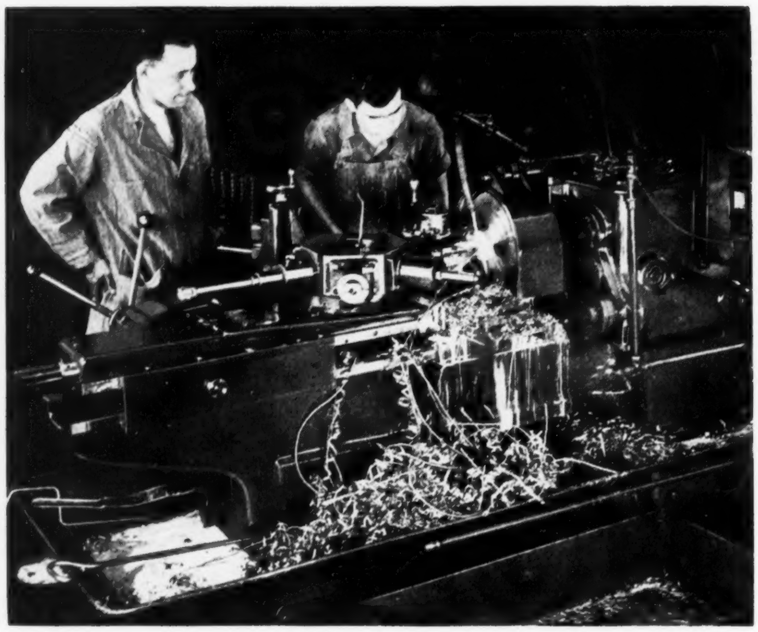


Fig. 3. Wire Emerges from the 140-foot Long Galvanizing Tank with a Multiple Coating of Zinc, at the Rate of 578 Miles a Day. This Illustration Shows Some of the Take-up Reels at the End of the Galvanizing Line. Approximately 43,000 Gallons of Solution are Required for the Electro-galvanizing Bath. Thirty Tons of Zinc Anodes are Used on the Bottom of the Tank

Fig. 4. Fifty-six Nail-making Machines in this Department are Belt-driven from Lineshafts Located in Tunnels underneath the Floor. The Driving Equipment for the Wire-drawing Machines and Electrical Control Equipment are also Located in Tunnels to Facilitate Material Handling



Apprentice Receiving Instruction by His Foreman in Turret Lathe Work

Trade Training

Recognizing the Need for Skilled Mechanics, Several Machine Tool Manufacturers Maintain Highly Organized Training Systems. This Article Describes the Trade Training Methods Employed by the Gisholt Machine Co.

FOR several years, the Gisholt Machine Co., Madison, Wis., has recognized the fact that when business revived, a shortage of skilled men would be inevitable. Accordingly, the company planned and put into effect training methods for young men who are anxious to learn a mechanical trade. The company has not only expanded its school for apprentices, but has broadened it to provide a short course for learners, through which, in eighteen months, men would become qualified to run some one type of machine or to assist in the operations of some one department. The object of this short course was to standardize the training of inexperienced selected men between eighteen and twenty-two years of age. In a relatively short time they are able to earn substantial wages and, at the same time, render service in an industry where skilled men are scarce.

In addition, the company maintains a regular four-year apprentice course for young men also between eighteen and twenty-two years of age. Each applicant, both for the four-year and eighteen-months courses, must have a high-school education or its equivalent. Boys that live in and around Madison are given preference, all other conditions being equal. Sons and relatives of employes are accepted, but must conform to the general standards set for all applicants.

Great care is taken in selecting the applicants. The schools that they have attended are consulted by letter and information obtained as to their school record, reliability, etc. Past employers, if any, are also consulted by letter. In this way, much information about the character and reliability of the prospects is obtained that might otherwise not be known.

Photographs of all applicants are taken and stapled to the applications. This practice has proved of considerable aid when vacancies are to be filled. The application cards give a general description of each applicant and his abilities, and the photographs help the apprentice director to remember the boys when they call to ask about their applications. At present, there are nearly three hundred applications on file, indicating that the high-school boy of today is anxious to learn a trade which will enable him to earn a living.

When a vacancy for an apprentice occurs, the apprentice director goes through the file of applications and chooses several of the most likely prospects. The boys chosen are then asked to call and are interviewed by one of the vice-presidents and by the plant manager of the company. If either one objects to the boy, he is not accepted, but another is asked to call. In this way, only boys that make a uniformly favorable impression are entered in the training courses.

The Training of Four-Year Apprentices

The four-year apprentices are indentured under the state laws of Wisconsin. The contracts used are supplied by the Industrial Commission of the state. The period of apprenticeship covers 2080 hours per year for each of the four years, or a total of 8320 hours. The average working week is 40 hours. The first 688 hours (approximately four months) of the training period constitutes a probationary period and must be completed in five calendar months.

The boys are required to go to a vocational school one-half day a week or a total of not less than 144 hours a year. The courses taught in this school are: Shop mathematics, shop terms, blueprint reading, drawing and sketching, and shop economics. The apprentice director keeps in con-

in a Machine Tool Plant

stant touch with the school, which sends him copies of the attendance and performance records of each boy monthly. Since the vocational schools in the state of Wisconsin are required by law to teach the subjects that the manufacturers want the apprentices to take, the apprentice director during his frequent visits may suggest changes that seem advisable in the various subjects taught.

The boys are paid for the hours spent in school at the same rate per hour as in the shop. The state law on this subject reads as follows: "The employer shall pay for the time the apprentice is receiving instruction, at the same rate per hour as for services. Attendance at school shall be certified by the teacher in charge and failure to attend school shall subject the apprentice to a penalty of loss of compensation for three hours for every hour such apprentice shall be absent without good cause."

The company also supplies the boys in the machinist's and toolmaker's courses with copies of "Machine Shop Technology," published by the Committee on Industrial Education of the National Metal Trades Association. This course is studied by the boys at home and the questions in the course answered. The answers are turned in to the apprentice director, who, in turn, corrects them and files them in his office with the other records of the apprentice's performance. These answers, provided with suitable covers, become the property of the apprentice upon graduation.

The machinist's course includes an appropriate amount of time spent in the following departments: Distributing, tool-room, drill presses, milling machines, small turret lathes, large turret lathes, planers and slotters, engine lathes, boring mills, gear cutting and hobbing, cylindrical grinding, tool grinding, stock-room, erecting floor, test floor, inspection, and foundry.

The toolmaker's course similarly includes an appropriate amount of time spent on the following machines (or departments): Distributing, tool-room, drill presses, lathes, planers, milling machines, boring machines, shapers, grinding machines in general, tool grinders, tool forging and tempering, bench work, tool repairs and the making of new tools, machine repairs, and laying out.

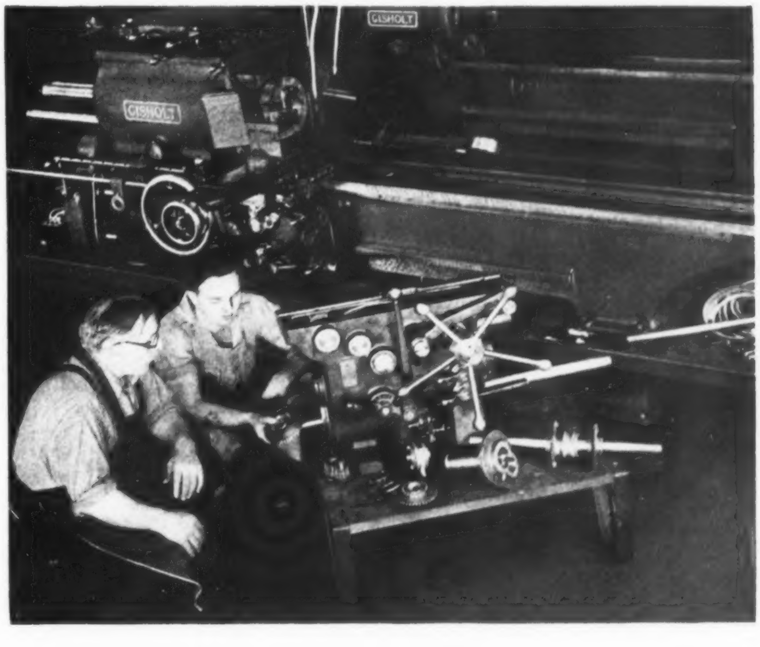
There is also a four-year course for patternmakers' apprentices and a similar course for foundry apprentices.

At the completion of the required hours of apprenticeship, the graduate apprentice receives the sum of $100, or its equivalent in tools and equipment, as a bonus for the completion of the contract. He also receives a diploma issued by the Industrial Commission of the state of Wisconsin.

Each apprentice has a record card that covers the whole four years of his apprenticeship. This card contains a complete record of the machines and processes at which the apprentice has worked, and gives the dates when changes were made from one machine or department to another. This record card makes it possible to note at a glance the kind of work the apprentice is doing, what he has already completed, and what he has still to do. Daily record cards are also filled out by the apprentice, showing exactly what he did on that particular day. This card also shows tardiness and time lost.

Once a month the foreman makes out a report covering each individual apprentice working in his department. These reports are forwarded to the apprentice director. They give a monthly picture of the apprentice from the foreman's point of view. An effort is also made by the apprentice director to keep in touch with the parents of all the boys. Much can be done along this line to the advantage both of the boy and of the company furnishing the training.

Another feature of the system that might be mentioned is that some of the applicants who are not employed are sent to a vocational school to take up machine shop work, in order to find out if they like it and if they are fitted for that kind of work. In two or three months' time the school can generally furnish all the information required to determine the applicant's fitness for the trade.



Apprentice at Work on the Assembly Floor Learning Something about Turret Lathe Construction

The eighteen months' training is believed to be original with the Gisholt Machine Co. in the state of Wisconsin. It has not yet been recognized as an "official" training course by the Industrial Commission of the state. The starting of this course was prompted by the great need for machine operators for the various departments in the Gisholt plant. It was impossible to wait four years for trained men. The period of training in this course is 3120 hours. These young men are required to go to a vocational school one-half day a week or a total of not less than 144 hours during the entire training period. The rules applying to the four-year apprentices also apply to those taking the eighteen months' course. They, too, are supplied by the company with sections of "Machine Shop Technology" and are required to answer the questions and turn them in to the apprentice director for correction and filing, the answers being returned to them upon the completion of the course.

The machines on which these eighteen-months apprentices are trained include drilling machines, horizontal boring mills, vertical boring mills, milling machines, engine lathes, turret lathes, screw machines, planers, shapers, and gear-cutting machines. In this course, the same as in the regular apprentice course, the first 688 hours (approximately four months) constitutes a probationary period which must be completed in five calendar months. The company issues a diploma to the apprentices upon completion of the course.

In addition to these apprentice courses, the company maintains a third class of training for engineering graduates. This course is of two years' duration; the recruits are carefully selected from engineering schools, and are thus prepared for work in the various branches of the business, according to their individual capabilities.

Unique Arrangement of Drill Press for Removing Burrs from Milled Slot

An interesting method of removing the burrs raised by a milling cut taken in the center of a small steel lathe bed is employed at the plant of the Delta Mfg. Co., Milwaukee, Wis. One of the small lathes made by this company for wood turning has a bed of pressed steel with steel cross-members welded in place at 6-inch intervals. The center slot for the headstock and tailstock keys is machined with a milling cutter, which leaves a heavy burr on the under side of the slot.

This burr was formerly removed by hand-filing, which was a slow operation, due to the interference of the cross-members on the under side of the bed. However, removal of the burr is now being accomplished economically and rapidly by means of a Woodruff key cutter mounted on the rearranged sensitive drill press shown in Fig. 1. The head of this Delta 14-inch drill press is reversed on the column, and the table is set above the chuck, which now points upward. The shank of the Woodruff key cutter extends downward through the hole in the center of the table and is held in the chuck. The quill of the drill press head is adjusted until the distance from the under side of the cutter to the drill press table is slightly greater than the thickness of the lathe bed in which the slot is milled.

One end of the slot is entered over the shank of the revolving cutter, and the bed, upside down, is then pulled across the table in the manner shown in Fig. 2, with the under side of the cutter bearing against the two edges of the slot. Not only is this burring operation faster and more satisfactory than hand-filing, but it can be performed by the milling machine operator while the slot is being milled in another bed.

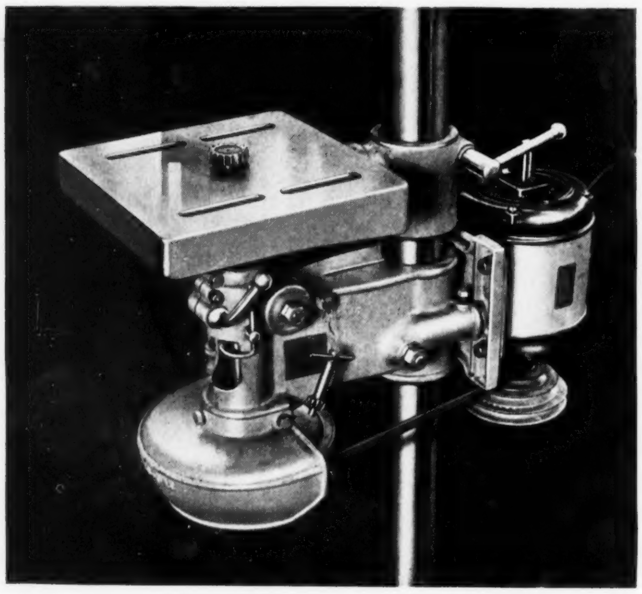


Fig. 1. Delta 14-inch Drill Press with Head Reversed on Column and Cutter Shank Extending Downward through Hole in Table

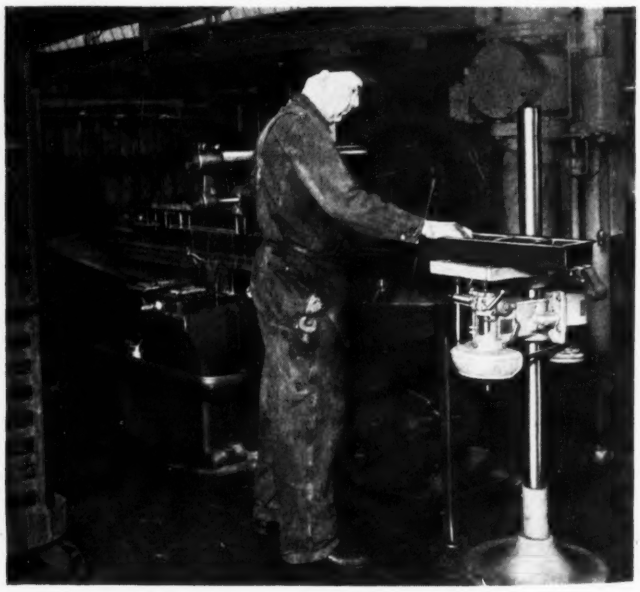
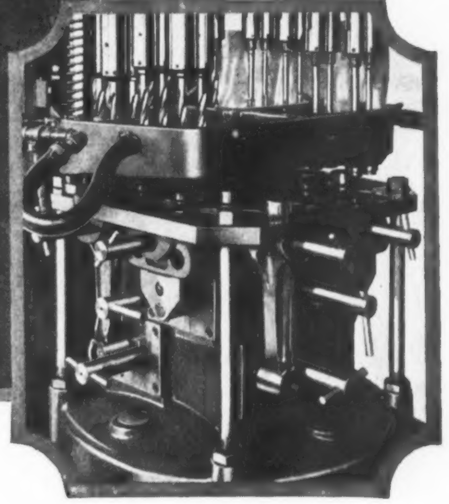


Fig. 2. Removing Burrs from a Slot Milled in a Small Lathe Bed, Using a Drill Press Arranged as Illustrated in Fig. 1

Design of Tools and Fixtures



Welded Construction Reduces Cost of 14-Inch Boring Head

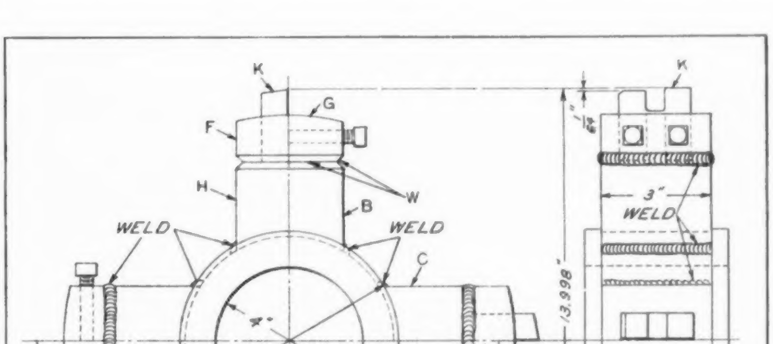
By HECTOR J. CHAMBERLAND, Springfield, Mass.

Welded steel construction solved the problem of producing economically a multiple-tool boring head for the accurate finishing of a 14-inch bore. By employing welded construction, the cost was cut practically in half, no pattern was required, there was no delay, and scarcely any material was wasted. As shown in the accompanying illustration, four single tool bits *K* are used. These bits have a cut-out or notch between the front section, which acts as a roughing cutter, and the finishing portion. The roughing cutter bores the hole 1/32 inch under size, while the finishing portion of the cutter brings the bore to within 0.002 inch of the required size.

The cylindrical member *A* consists of a piece of seamless steel tubing, 4 inches long, having an outside diameter of 6 inches and a 4-inch bore. As the bore of the tubing was the size required for the boring head, very little machining was necessary on this part. The ends of the part were faced, the keyway cut, two 7/16-inch holes tapped, and a recess 1/8 inch deep and 3 inches wide was turned on the outside of the tubing to facilitate accurate location of the members *B*, *C*, *D*, and *E*. Each member is made in three parts *F*, *G*, and *H*. This construction saves considerable time, as it is unnecessary to machine the four rectangular tool slots in the usual manner. These slots, each 1 1/4 inches deep by 2 inches by 3/4 inch were produced by milling open slots in two pieces which were, in turn, welded to a block 3 inches square. The only machining required on the four blocks was the milling of a radius corresponding to that of the recessed diameter of part *A* and the surfacing of the opposite end.

After welding the double tool bit sections to the blocks, the parts were tapped to receive two 3/8-inch set-screws. The parts joined by welding were chamfered as shown at *W*, to facilitate the production of a strong welded joint. After the four cutter-holding members were assembled, they were welded to the part *A*. The complete welded unit was then fitted permanently to its arbor, the hubs refaced, and the outer ends of the cutter-holders turned.

The high-speed steel cutters, which had previously been ground to fit each slot, were next inserted and securely bolted in place, after which the tool was tested and found to meet the accuracy requirements. A



Multiple-cutter Boring Head of Welded Construction

1/16-inch flat is provided on the corners of the roughing sections of the cutters, while the corners of the finishing portions are stoned to a 1/64-inch radius. This tool-head was made by two men in seven hours.

Die for Puffing, Closing, and Indenting Brass Tubes

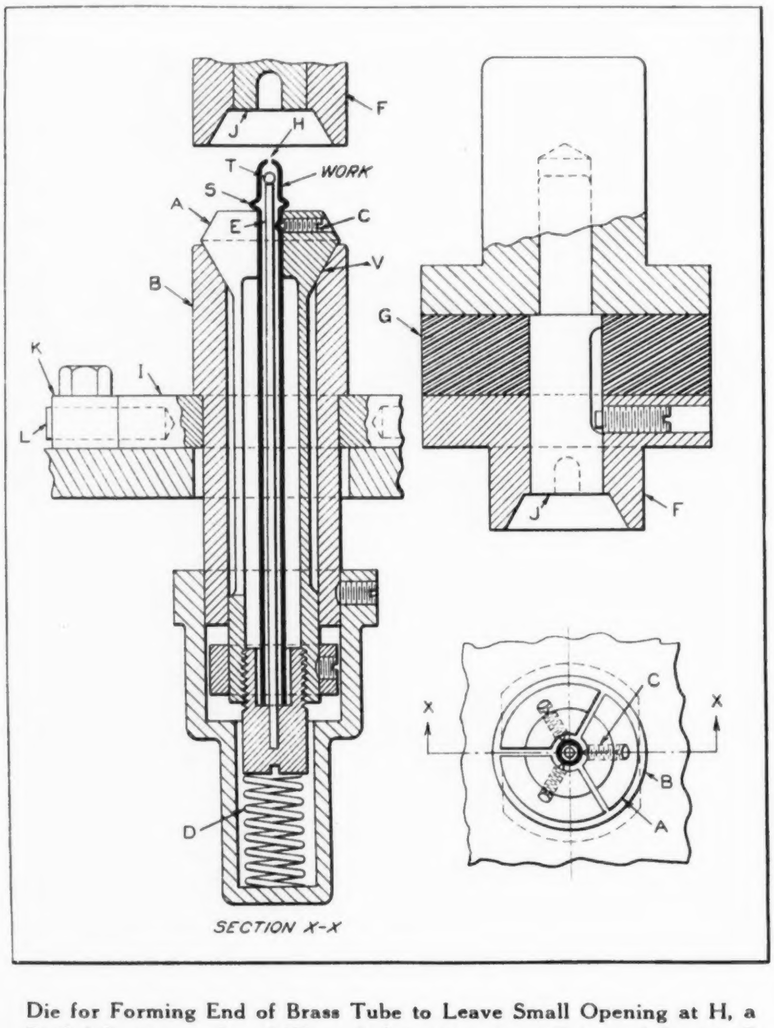
By GEORGE WILSON, Marshalltown, Iowa

The part designated as the work in the accompanying illustration is being made into a spout for a pump type oil-can. Quantities of these spouts are made from brass tubing having an outside diameter of 1/4 inch. The work performed by the die consists of puffing or bulging the tube at *S* for the attachment of a thumb-operated lever; closing the end of the tube so that the hole *H* is only 1/16 inch in diameter, and indenting the sides of the tube in three places below the puffed section *S* to retain the ball *T*.

The lower member of the die is mounted in a plate *I*, which is located between two parallel guide pieces *K*. Plate *I* is provided with trunnions *L*, which permit tilting the die forward, so that the long brass tube can be easily inserted. After the tube has been placed in the die, the ball *T* is dropped into the open end. This ball, in conjunction with the seat formed by the closed end of the tube, constitutes a check valve. The rod *E* serves to hold the ball in position while the end of the tube is being closed and the sides indented.

The split collet *A*, in which the work is placed, has three jaws, as indicated in the plan view in the lower right-hand corner of the illustration. Each jaw has a pointed screw *C* which produces an indentation in the tube when the jaws are closed tightly around the tube. The spring *D* serves to raise the collet, so that the jaws can open wide enough to admit the work, which must pass between the indenting points of screws *C*. The closing of the jaws with sufficient pressure to indent the tube and grip the work for the bulging or puffing operation is accomplished on the down stroke of the press ram when the tapered end of the punch *F* comes in contact with the tapered end of collet *A*, forcing it into the taper *V*.

Punch *F* is a sliding fit on the hardened forming die *J*, and is backed up by a rubber pressure pad *G*, made up of sections cut from an automobile tire. The rubber pad exerts sufficient pressure on the collet to force it to hold the work stationary while the end is being closed in or formed, and thus prevents the tube from bulging. Further compression of the rubber pad takes place on the completion of the downward stroke, when the tube is bulged at *S*.



Die for Forming End of Brass Tube to Leave Small Opening at H, a Puffed Section at S and Three Indentations from Points of Screws C

Storing Loose Bushings

By F. MUIR, Hamilton, Ont., Canada

Comparatively few drill jigs have fixed bushings only, the majority requiring auxiliary slip bushings for drills, reamers, and counterbores. If no suitable provision is made for storing the bushings when they are not in use, considerable time may be lost in searching for them when they are needed. In some shops, the bushings are threaded on a piece of string, the ends of which are tied together and the loop thus formed hung on the jig; but the string sometimes breaks and the bushings become lost.

There are several methods of storing or caring for bushings, however, which are satisfactory. Small jigs, for example, with a few loose bushings may have the bushings safely stored by placing them in the bushing plates with their heads on the inside. Bushings may also be placed

inside box jigs and held by closing the lid. When the jig has a hole large enough for the bushings to drop out, they should be put in a tin box that will fit inside the jig. If the shape of the jig is such that an ordinary box cannot be used, a special box can be made to fit inside the jig.

In cases where there are too many bushings to fit inside a shallow jig, a bar holder can often be used to advantage. The bar is made of steel and is long enough to take all the bushings. It is threaded at each end and pushed through two holes on opposite sides of the jig, being allowed to project at each side. The bushings can be placed on the bar both inside the jig and on the ends, so that when nuts are tightened up on the ends of the bar, the holder practically becomes a solid part of the jig and there is no danger of losing the bushings.

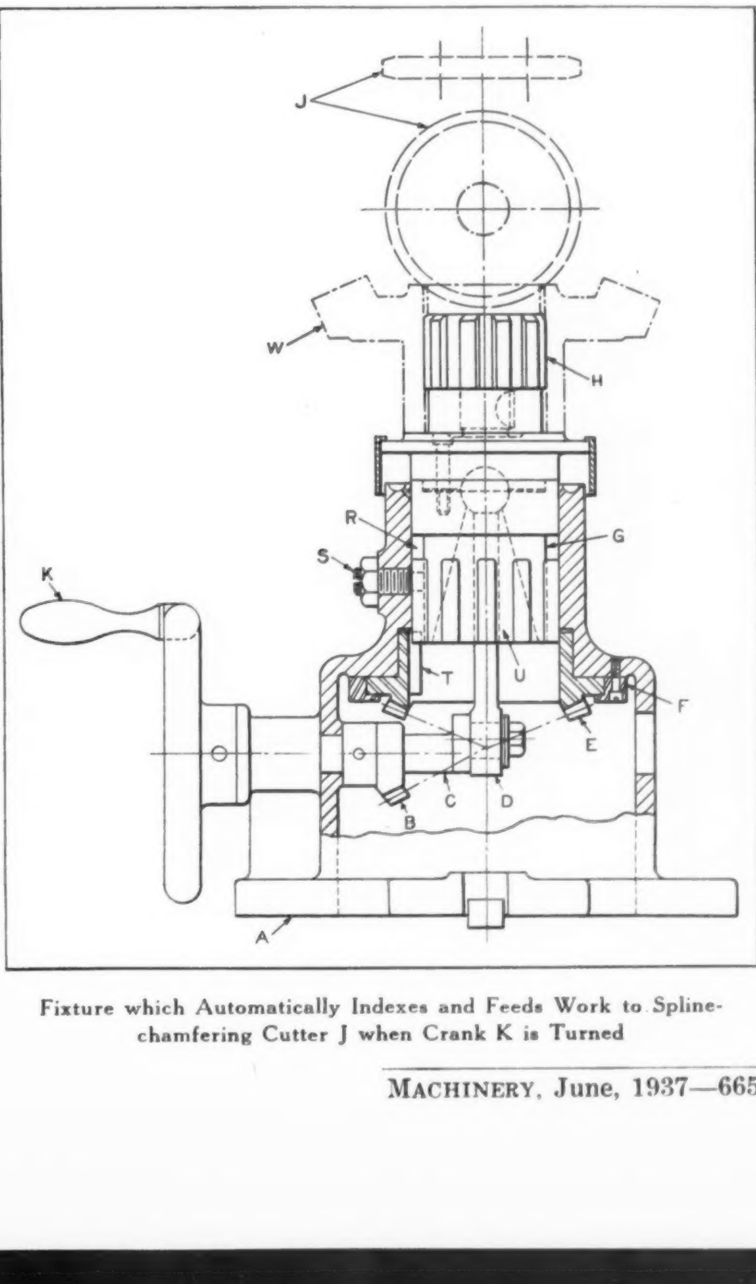
None of these methods can be used when a jig has a very large number of slip bushings. For cases of this kind, the writer makes a shallow box with pegs on which the bushings can be placed in the order in which they are used. This box has a locked lid. It must not be deep enough to allow the bushings to come off the pegs if the box is turned upside down when the lid is closed. If the box is used without pegs, a card listing the number and size of the bushings is generally enclosed, but such cards often become so badly defaced that it is almost impossible to read them. For this reason, the writer, whenever possible, stamps the required information on a face machined on the jig. Such information becomes part of the jig and cannot be destroyed.

Crank-Operated Fixture which Automatically Indexes Work for Chamfering Splines

By MARIUS J. MERLIN, Cleveland Heights, Ohio

An ingenious fixture for simultaneously chamfering the two sides and the bottom of two splines of a hole having an even number of splines is shown in the accompanying illustration. The chamfering operation is performed by feeding the work *W* on locating plug *H*, to the angular cutter *J*.

Turning the crank *K* of the handwheel causes the crankshaft to draw the indexing piston *G* down until groove *R* is in line with the guide screw *S*. The gear segment *B* at this point will engage the indexing ring gear *E*, and driving through gear key *T*, will index piston *G* until the succeeding slot *U* is in line with the guide screw *S*. At this point, the gear segment is disengaged and the piston begins its up stroke, which ends in the chamfering of the splines by cutter *J*.



Fixture which Automatically Indexes and Feeds Work to Spline-chamfering Cutter J when Crank K is Turned

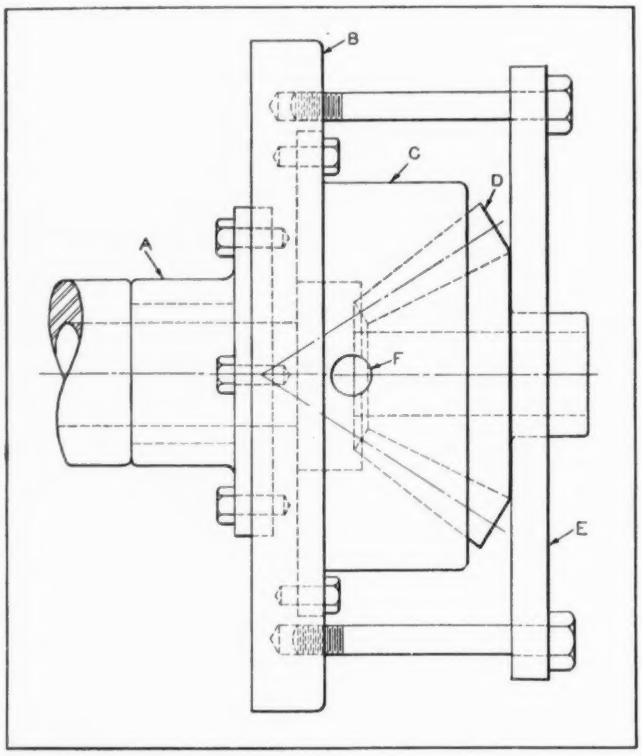
Bore-Grinding Fixture for Hardened Gears

By GEORGE DES CHENES, Hartford, Conn.

Bevel and miter gears, as well as gear-cutters, must be accurately trued up for grinding their bores after being hardened. The truing-up operation often consumes considerable time, especially if the work is mounted on a regular faceplate. Of course, special fixtures are provided which quickly and accurately line up the work when large quantities of gears or cutters are produced. However, the simple fixture illustrated (see next page) was designed for use in a plant where gears are made up in small lots of twelve or multiples of twelve. It accommodates eighteen different sizes of gears having different cone angles, the largest gear being 4 inches in diameter with a 2-inch face.

Until recently, these gears were mounted on a faceplate for the bore-grinding operations, which kept a man continually at work. It was to save time on this job that the fixture shown was constructed. With this equipment, all internal grinding is now done in less than three days, whereas with the old equipment, as much time was required to true up the parts as for the actual grinding.

Referring to the illustration, the interchangeable



Fixture for Use in Grinding Bores in Hardened Gears

adapters *C* are machined to receive the various gears to be ground. The main plate of the fixture is made in two parts *A* and *B*. The part *A* is threaded to fit the tailstock spindle and is bolted to the part *B*, while part *B* is counterbored to receive adapter *C*, which is held to *B* with but two bolts. Gear *D*, the bore of which is to be ground, is self-truing in the adapter *C*, and is firmly held in place by the strap *E*. A 1/2-inch hole *F* is drilled in the adapter to permit the grinding wheel to be seen when near the end of its inward travel.

Since the gears ground by the aid of this fixture are nitrided, the errors due to distortion from hardening are comparatively slight. Formerly the time required for truing up a gear averaged six minutes, whereas the loading and strapping of the work in the new fixture requires only about one minute.

Chuck for Clamping Work Between Shoulders

By FRED HORNER, Bath, England

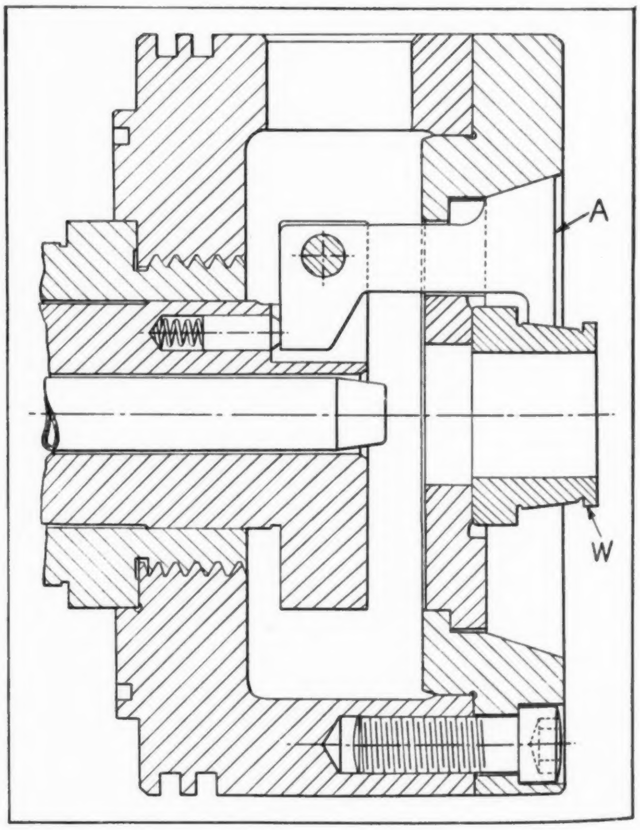
For some internal grinding operations, the work must be clamped between shoulders and on a tapered surface, as shown in the accompanying illustration. Quick-acting collet chucks are utilized in this case for holding the work *W* in preference to sliding jaws. The illustration shows how a cone can be centered and held by three pivoted jaws like the one shown at *A*. These jaws are closed concentrically by the movement of the cone plate.

British Machine Tool Imports

The imports of machine tools into the United Kingdom in 1936 were over double the value of the 1935 imports. Turning machines of various kinds constituted the largest group, valued at about $5,000,000; milling machines came next, to a value of over $3,000,000, followed by grinding machines to a value of approximately $2,600,000. The total value of the 1936 machine tool imports into the United Kingdom amounted to approximately $18,000,000, of which the United States supplied $10,500,000, and Germany, $4,750,000. The British Government placed approximately 300 separate contracts for machine tools during 1936. These figures are based upon information obtained from Trade Commissioner Edward B. Lawson of London, England, as published by the Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C. Twenty-three per cent of the machinery imported was granted duty-free entry into the United Kingdom under license. The ground for issuing such permits has been that the equipment is not obtainable at present in the United Kingdom. The importer must apply for a license for each shipment.

* * *

Many a bright idea has never become a practical success because it has been given six times as much publicity as thoughtful consideration.



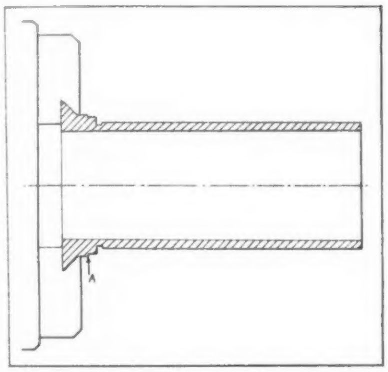
Three-jaw Chuck Designed to Center and Hold Work on Tapered Surface

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Machining Cylinder Liners

By designing cylinder liners with cone-shaped bases like the one shown in the accompanying illustration, chuck jaws can be machined to fit the conical surfaces and thus provide a simple means of holding the work securely. After the liner has been bored and turned, the base is cut off, leaving the end finished at *A*.



Cylinder Liner Held by Cone-shaped Base which is Cut off after Machining Bore and Outer Surface

When this liner is being machined, a guide bar projects from the spindle. Over this bar slides the turret boring head. A steady-bushing which enters the bore is located at the rear of the boring head. At the same time that the bore is being machined, tools on an arm of the turret-holder turn the exterior of the liner. Finally, a bar carrying two steady-bushings enters the bore and keeps it true while the recess next to the shoulder is necked in and the liner cut off.

Bath, England — FRED HORNER

Double V-Block for Locating Shaft Centers

A novel method of locating the center of the end of a shaft is made possible by providing a pair of double V-blocks like the one shown in the accompanying illustration. The center of any size shaft within the capacity of the V-block can be found in the following manner: First, the shaft is placed in the 90-degree vee to the left, and a surface gage scriber is set to the same height as the top of the shaft. The shaft is then transferred to the vee to the right, and the surface gage used to draw a line across its end. This line will be exactly in the center of the shaft.

In making a pair of these V-blocks, the 90-degree vee is first machined and a shaft placed in the vee. The surface gage scriber is then set to the top of the shaft and the height transferred to the right to intercept a vertical line at the point where the second vee is to be machined. Using the intersection of these scribed lines as a center, a circle is laid out which has the same diameter as the shaft. From a point below the circle and at the same height as the bottom of the 90-degree vee, two lines are scribed which are tangent to the circle at either side. The second vee is then machined to these lines.

Hamilton, Ont., Canada — F. MUIR

Drilling a Deep Hole in Soft Copper

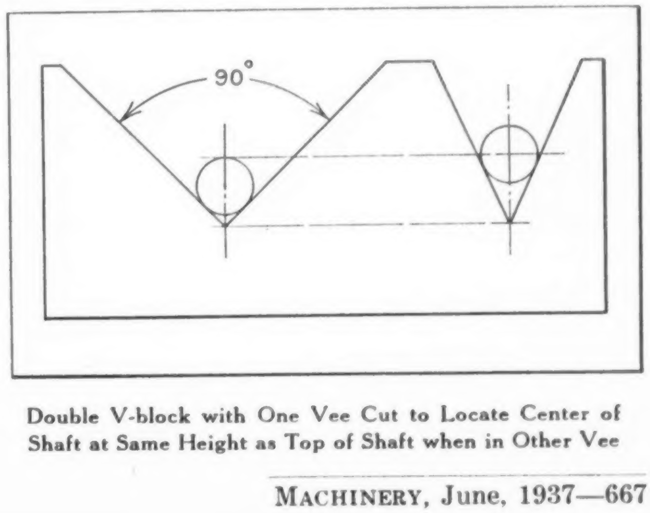
In drilling a hole 0.025 inch in diameter, 1 inch deep, in soft copper, much difficulty was experienced because of drill breakage. The following method finally gave satisfactory results.

A piece of copper was centered in a high-speed Rivett bench lathe. The drill was held in a chuck with only a small part of it protruding at first. As the drilling proceeded, the drill was advanced 1/8 inch at a time from the chuck. A cutting compound of white lead and lard oil was used. By withdrawing the drill rapidly, it was possible to free it of chips and to finally drill the hole clear through the piece.

North East, Pa. — LLOYD J. HERRIMAN

* * *

At the present time from 10 to 15 per cent of all iron castings made are molded from alloy cast iron, and almost one-third of the iron foundries in operation use alloys for at least a part of their casting production.



Double V-block with One Vee Cut to Locate Center of Shaft at Same Height as Top of Shaft when in Other Vee

Climb and Conventional Milling Advantageously Combined

Operations on Brown & Sharpe Milling Machine in which Cuts are Taken Both with and against the Feeding Direction of the Work

CLIMB milling differs from conventional practice in that the cutter is revolved so that its teeth meet the work in the direction of the table travel, whereas in conventional milling, the cutter teeth move in the opposite direction to that of the table. Climb milling possesses an important advantage in that it enables pieces that are difficult to clamp securely in a fixture or on the machine table to be efficiently milled. The downward action of the cutter teeth in climb milling such pieces tends to seat them firmly in the holding devices. Cutters used in the conventional manner would tend to lift the pieces from their seats and might make the operation impractical.

A climb milling operation in which pieces of cold-rolled sheet steel are machined to an irregular contour is illustrated in Fig. 1. This operation, as well as all others here illustrated, is performed on a Brown & Sharpe No. 12 plain milling machine (electrically controlled). Thirty pieces are clamped in the fixture at one time and milled along one edge with a single movement of the table past the cutter. The pieces are then reversed in the fixture and the opposite edge milled with a second movement of the table past the cutter. The production is at the average rate of 185 pieces finished on one edge per hour, or 92 pieces milled complete on both edges.

The formed cutter is 4 inches maximum diameter and is run at a speed of 85 revolutions per minute, the table feed being 1 5/8 inches per minute, or 0.019 inch per cutter revolution. These cuts are taken easily in spite of the large amount of stock removed.

Taking Roughing and Finishing Cuts with the Same Cutter

When climb milling is employed in combination with conventional milling and a reverse movement of the machine table, work pieces can be conveniently rough-milled with one movement past the

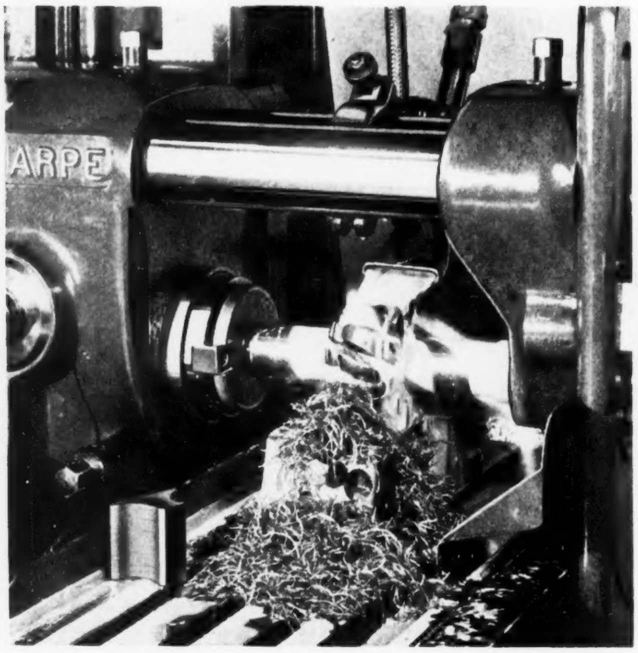


Fig. 1. Form-milling Thirty Pieces of Cold-rolled Sheet Steel Simultaneously by Employing the Climb Milling Principle

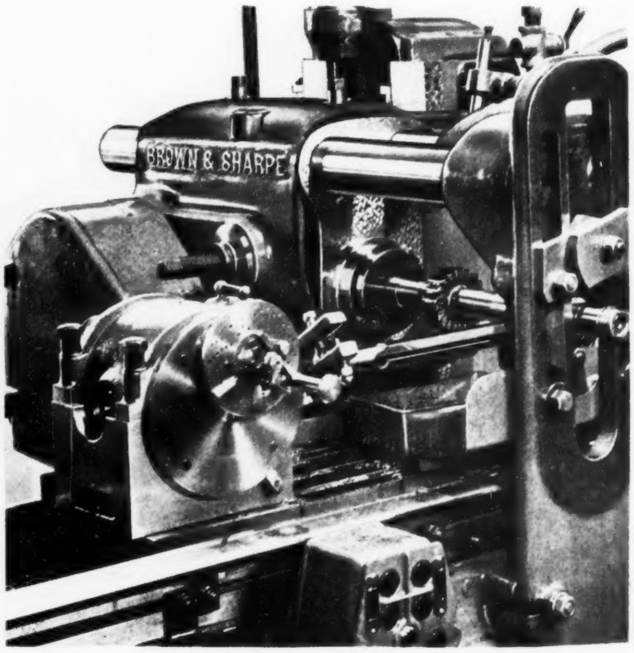


Fig. 2. Roughing out the Flutes of High-speed Steel Taps by Climb Milling and Finishing them in the Conventional Way

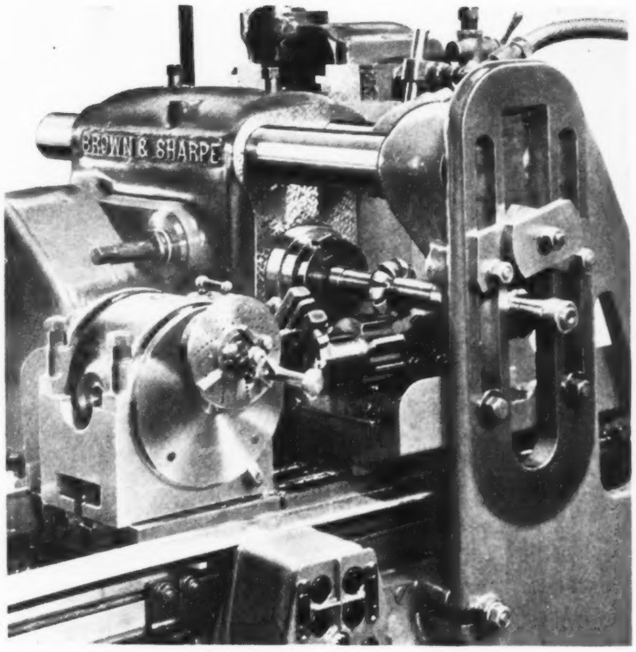


Fig. 3. Another Operation in which the Flutes of a Tap are Roughed out by Climb Milling and Finished by Conventional Milling

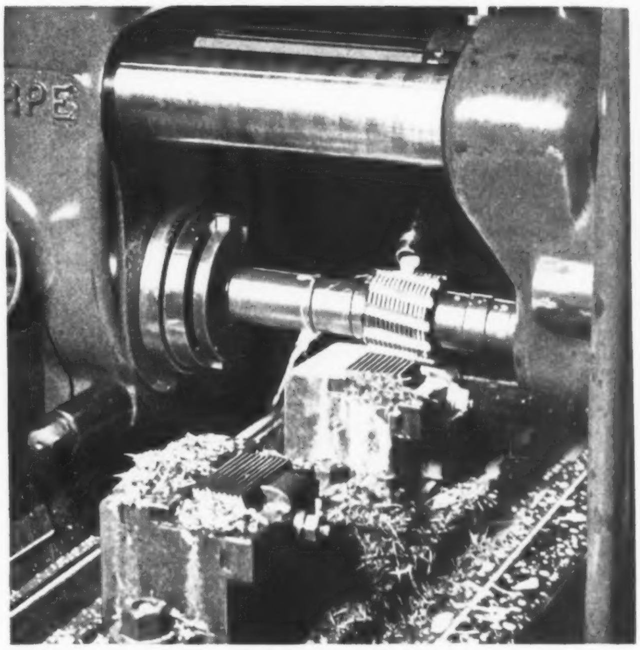
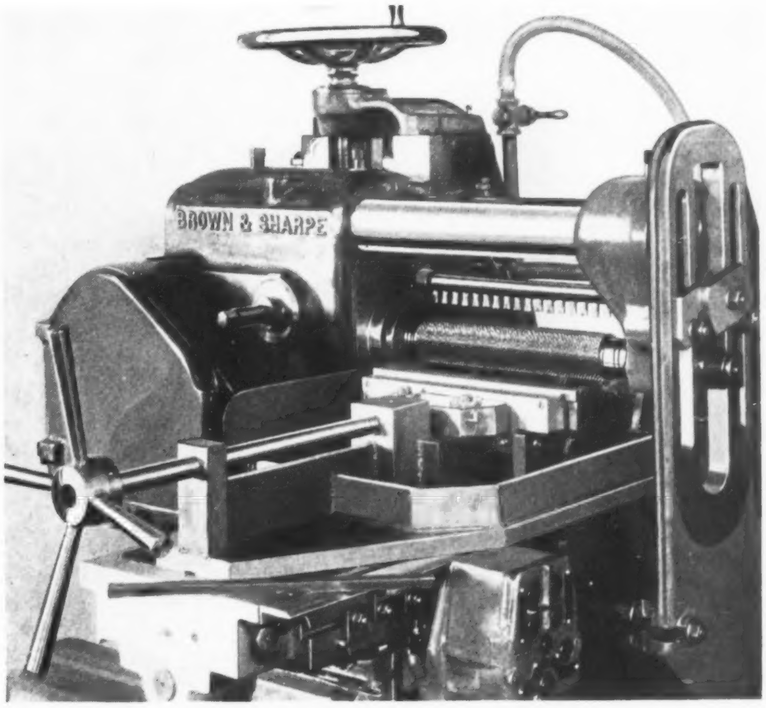


Fig. 4. Climb and Conventional Milling Used in Combination, together with Duplex Fixtures, Permit a Continuous Automatic Machine Cycle

cutter and then finish-milled during the return movement. The cutter, of course, revolves constantly in the same direction. This principle is shown being applied in Fig. 2 for milling four flutes 8 inches long in a tap blank of high-speed steel.

The roughing cut is taken smoothly by climb milling while the table is fed from left to right, and the finishing cut is taken by conventional milling as the table returns. The work is held on index-centers so that it can be conveniently indexed for machining the successive flutes. The cutter is 4 inches in diameter and is made with an included angle of 85 degrees between the side- and face-cutting edges. It is run at a speed of 60 revolutions per minute, which gives a surface speed of 63 feet a minute. The table is fed 2 9/16 inches per minute, or 0.043 inch per cutter revolution, during both roughing and finishing, although the machine is so controlled that a much faster feed

Fig. 5. Another Example of Continuous Automatic Milling with Two Fixtures and One Set of Cutters, Climb Milling being Performed on the Work Held in One Fixture and Conventional Milling on the Work in the Opposite Fixture



could be used for finishing if desired. The depth of cut in roughing is 3/8 inch, and the width of cut is 5/8 inch.

Another instance of roughing by climb milling and finishing by conventional milling is illustrated in Fig. 3. This operation consists of milling eight flutes in a hand-tap blank of high-speed steel. Each flute is 2 inches long. The formed cutter is 3 1/2 inches in diameter and takes a cut 35/64 inch deep in the roughing, the cut being taken smoothly in spite of the large amount of stock removed. The spindle speed is 60 revolutions per minute, which gives a cutter surface speed of 55 feet per minute. As in the preceding operation, the table feed is 2 9/16 inches per minute, or 0.043 inch per cutter revolution.

Combined Climb and Conventional Milling Facilitates the Use of Duplex Fixtures

Time-saving machine cycles that would otherwise be impracticable are often made possible by combining climb and conventional milling. This is primarily true when duplicate fixtures are used on opposite ends of a machine table and reversal of the table is utilized to obtain a continuous automatic cycle. An unusual operation of this type is illustrated in Fig. 4. This consists of milling the teeth in special chaser blanks of tool steel at a table feed of 4 inches per minute. While work is being milled in one fixture, the other fixture can be reloaded so as to enable the machine to operate without interruption. Climb milling is performed on pieces held in the left-hand fixture and conventional milling on pieces in the right-hand fixture.

Another operation in which duplex fixtures, climb milling, and conventional milling permit a continuous machine cycle is shown in Fig. 5. Approximately 125 cutters climb mill a similar number of slots simultaneously across one side of long slender bars, such as seen on the left-hand end of the table. Each fixture holds two bars per load. Slots of a different depth are then cut on the opposite side of these bars by conventional milling in a similar fixture at the right-hand end of the machine table.

* * *

Two Old-Timers

Large tools were required even thirty years ago. About 1908, when the Westinghouse company was building some turbo-generators that were large for that day, large tools, especially drills, were required for the work. These drills varied from 3 1/2 to 4 1/2 inches in diameter. They were 7 feet in length and made from high-speed steel. The drill manufacturers were not in a position to furnish drills of this size; hence the Westinghouse company set out to make them.

The illustration shows Francis S. Walters, now tool engineer of the Westinghouse East Pittsburgh Works, with one of the drills, which he was responsible for making. This drill is 4 1/2 inches in diameter and 7 feet long, and is provided with tubes for coolant. The flutes are 5 1/2 feet long, and the drill has a No. 7 Morse taper shank with a draw-hole or slot to receive a driving key. It was necessary to make some arrangement at the shank end of the drill to force coolant under pressure to the drill cutting point in order to remove the chips while the drill was revolving. Leather washers were used as packing between the disks, and an eyebolt prevented the disk with the hose connection from turning.

Francis S. Walters, Tool Engineer of the Westinghouse East Pittsburgh Works, as He Appeared in 1908 with the 7-foot Drill that He Made at that Time

The drill was made out of 1 1/8-inch by 5-inch flat stock high-speed steel, heated and twisted in the forge shop. The evenness of the gradually increasing twist from the shank to the point should be noted. The grooves were milled to receive the coolant tubes. The taper shank and rings were fastened to the flat shank by two half-pieces with holes drilled in the flat portion. The halves were riveted together and turned. The larger piece was bored and shrunk on this turned part. Then the taper was turned, allowing for a shoulder threaded for the assembly of the rings. These large drills were in service in the Westinghouse shops until a few years ago.

Mr. Walters, who was responsible for making these drills, entered the employ of the Westinghouse Electric & Mfg. Co. in April, 1900. After serving as night foreman for one year, he was made assistant tool-room foreman in 1902, a job that he held until 1907, when he was appointed foreman of the tool-room and later general foreman. In 1920, he was appointed supervisor of tools for all plants, which position he held until he was made tool engineer of the East Pittsburgh Works. He has represented the Westinghouse company on many committees on standardization, organized by the American Society of Mechanical Engineers and other societies.

Auto Pistons Ground Elliptical by the Plunge-Cut Method

One of the developments in automotive pistons during the last few years has been to grind them elliptical instead of to a true circular shape, the minor axis of the ellipse through the pin bosses being only a few thousandths of an inch shorter than the major axis. The elliptical shape compensates for unequal radial expansion when the piston is placed in service.

The grinding of elliptical shaped pistons presents certain difficulties, especially with pistons having a split skirt, as the locating centers of the grinding machine tend to spread the skirt. Pistons of this type are being ground in one large plant in 10- by 18-inch Cincinnati plain hydraulic grinding machines. Two of these machines are used for rough-grinding, and four for finish-grinding. Each machine is equipped with an "Ohio" cam attachment which adapts it for grinding ovals, this attachment replacing the standard footstock. Incidentally, it is not necessary to remove the attachment in order to grind round parts.

The pistons are of cast aluminum and are reinforced at the pin bosses by steel struts. A vertical slot in the skirt joins a cross-slot under the third ring groove. This construction permits the skirt to expand or contract freely.

The piston skirt is ground to an ellipse by the in-feed or plunge-cut method, the machine being equipped with a grinding wheel 3 inches wide which is the same width as the piston skirt. The accuracy of the piston profile at any point on the diameter must be within 0.0015 inch, and the skirt must be parallel with the center line of the piston from top to bottom within 0.0003 inch. From 0.010 to 0.012 inch of stock is removed by the rough-grinding operation, and from 0.004 to 0.005 inch by finish-grinding.

The piston is withdrawn 3/8 inch from the wheel at the end of the grinding cycle of both roughing and finishing machines, so as to facilitate loading and unloading. Also, the machine table is traversed about 4 inches to one side for the same purpose.

* * *

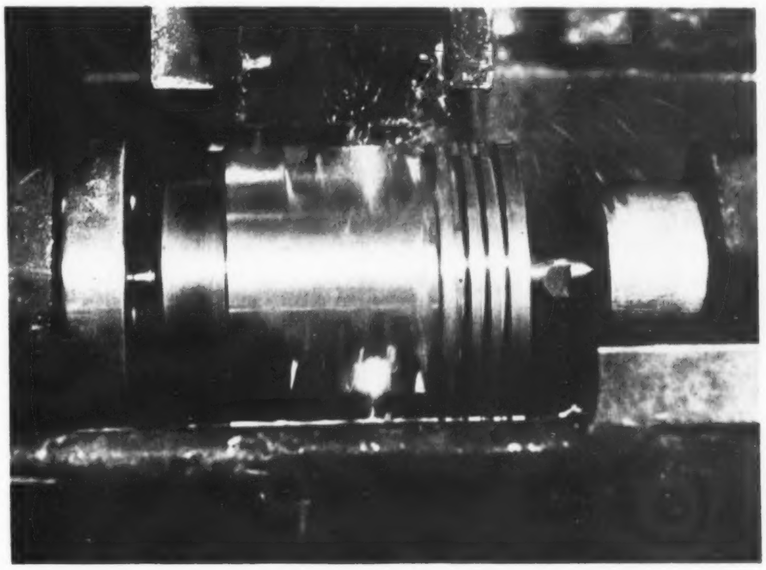
Railroad Buying Highest Since 1930

The railroads of the United States in 1936 bought more materials and supplies than in any year since 1930. These purchases, including fuel, totaled over $800,000,000, an increase of more than $210,000,000, or 35.5 per cent, above those in 1935. Iron and steel products were bought for approximately $274,000,000, as compared with $157,000,000 in 1935. This classification includes locomotives, wheels, axles, tires, steel rails, etc.

What Wages will Buy is the Real Test

A discussion of the relation of machinery to consumer purchasing power, as reflected in wages compared with prices of manufactured goods, is contained in a booklet recently published by the Machinery and Allied Products Institute, 221 N. LaSalle St., Chicago, Ill., entitled "Technology and the American Consumer." This booklet contains some interesting facts relating to wages and consuming power, and also makes comparisons with other countries throughout the world.

An interesting comparison shows that the average American hourly wage will buy 50 per cent more of twenty-three basic food items than the average hourly wage in Sweden, which country, except for the United States and Canada, has the highest wages in the world. Compared with Great Britain, the average American hourly wage buys twice as much in basic food products. Other comparisons between wages and purchasing power in 1914 and today show that today many fewer hours of labor will buy the same amount and quality of clothing, hats, shoes, house furnishings, rugs, etc., than in 1914. Single copies of the booklet are obtainable from the Institute free of charge; copies in quantity will be supplied at cost of printing.



Grinding Automotive Pistons to an Elliptical Shape with a Wheel of the Same Width as the Skirt

* * *

A Successful Suggestion System

During 1936, employes of the General Electric Co. were paid $51,357 for new ideas adopted through the company's suggestion system. Nearly 22,000 employes submitted suggestions. About 16,000 suggestions were received in 1935, when cash awards were paid to the amount of $35,360.

Color is Assuming New Importance in Industry

The Effect of Paint and Color on Lighting Conditions, Manufacturing Efficiency and Production is being Appreciated to an Ever Increasing Extent in the Mechanical Industries

By R. H. HOOKWAY
Sherwin-Williams Co., Cleveland, Ohio

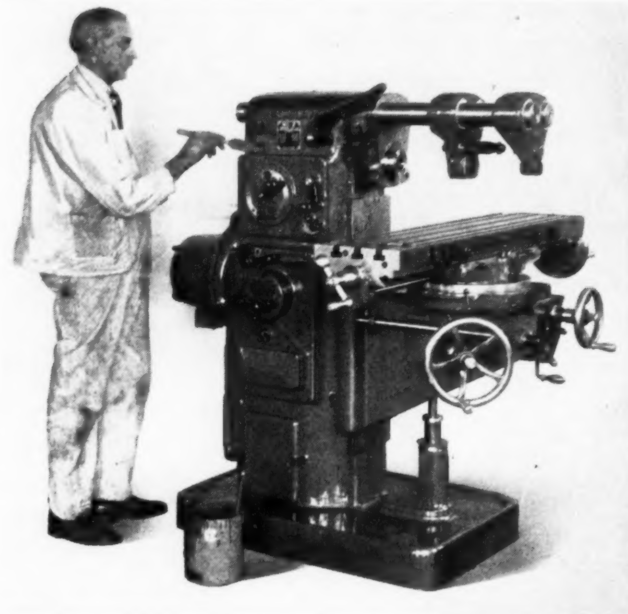


Fig. 1. Ease of Operation of a Machine Tool is Facilitated by Painting Levers and Handles a Different Color from that of the Machine Itself. Black Levers, for Example, Stand out Well against the Machine Tool Gray Surface of the Column. A Lighter Color on the Column would Give Still Better Contrast

PAINT and color, formerly considered necessary but unimportant details in the everyday work of the mechanical industries, have recently been accorded much greater attention by many executives in this field. Some well-known companies, among which may be mentioned the Toledo Scale Co., the Simonds Saw & Steel Co., and the American Rolling Mill Co., have effectively applied paint as an aid toward increased production.

It has been shown that adequate illumination has an important bearing upon production. Adequate illumination depends largely upon the character of the light-reflecting surfaces surrounding the worker. That is where paint comes in. No superintendent would knowingly tolerate conditions that made it necessary to consume sixty minutes for an operation that could be done in fifty. He lays out his plant for the most economical production, installs new equipment to speed up the output, and hires time-study men to eliminate lost motion; yet the same man frequently overlooks one of the simplest methods of accelerating production and improving the morale of his workers.

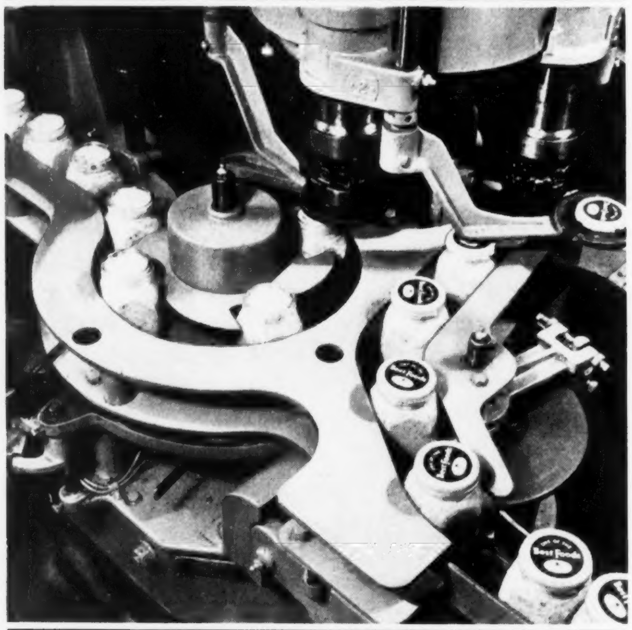


Fig. 2. Machinery Painted Pastel Green Gives a Pleasing Appearance to the Food Products Plant Where this Machine Operates. Walls and Ceilings are White

Consider the conditions surrounding the worker at his machine! Not only does his safety depend upon adequate illumination, but the speed and accuracy with which he can perform his work are equally aided by better light. Management endeavors to provide enough light, but much of this light is lost. In the average machine shop, most of the surfaces surrounding the operator are dark. They reflect only a part of the light provided, the rest is absorbed. The less the amount of light reflected, the greater is the effort of the worker to see what he is doing.

It is in relation to this phase of the production problem that paint proves to be an efficient and economical means of increasing output without increasing effort. The correct use of paint and color improves visibility to a degree formerly thought impossible by management and worker alike. If it is

logical to conserve the operator's energy by eliminating useless motions, it is equally sensible to eliminate the drag of production due to physical and mental strain created by poor "seeing" conditions.

Unfortunately, most plant interiors are painted more in accordance with tradition than with a view to securing all the available advantages of improved visibility. Machine tools and shop equipment have since the very beginning of mechanical work been painted in dark colors. However, there is now a tendency on the part of manufacturers to employ paint in such a way as to profit by the brighter colors. Some, including Ford, paint castings and other work to be machined, as well as the machines themselves, in colors having greater reflective power—that is, colors that provide greater visibility. Many plant managers have discovered that the old familiar commodity—paint—provides a means of improving human performance in almost every production operation.

The laws of color and light must be known, however, if hit-and-miss methods are to be avoided and the best results obtained. A thorough knowledge of the proper methods of applying color and light is held at present by a comparatively small group of color and paint experts; but their services and advice are available through many of the larger paint manufacturers.

In the Ford plants, many lathes, milling machines, and grinders are "spotted" white at the part of the machine where the cutting action takes place, thus improving the visibility. The CeCo Co., radio tube manufacturer, finds it necessary to use a series of gas-jets, placed in a circular arrangement, for a certain operation. The machines in which this work is performed are painted a light orange to contrast with the greens and blues of the gas flames. During the first week after this painting was done, the number of tubes rejected decreased by 60 per cent. In the plant of the Wright Arch Preserver Shoe Co., eye-strain was eliminated for operators working on black shoes with black thread on black machines, by simply painting the machines in light colors. The Freeman Shoe Co. painted its machines in bright colors, and obtained thereby a better product.

There has been as much research behind the selection of correct colors to increase productivity as there is in the designing of a machine. It is well known that the color of artificial light will change the apparent color of an object viewed under that light. The accompanying table indicates how colors will change according to the color of the source of light.

Color of Source of Light	Actual Color of Surface	Apparent Color of Surface
Blue	Red	Violet
	Orange	Brown
	Yellow	Green
Red	Yellow	Orange
	Light Blue	Violet
Green	Red Orange	Brown
	Orange	Yellow
	White	Green
Amber	Red	Dark Orange
	Dark Blue	Gray
	Violet	Maroon

Another important factor to consider in choosing colors to improve visibility and increase output is the "legibility" of a color—that is, what color shows up most clearly against some other color.

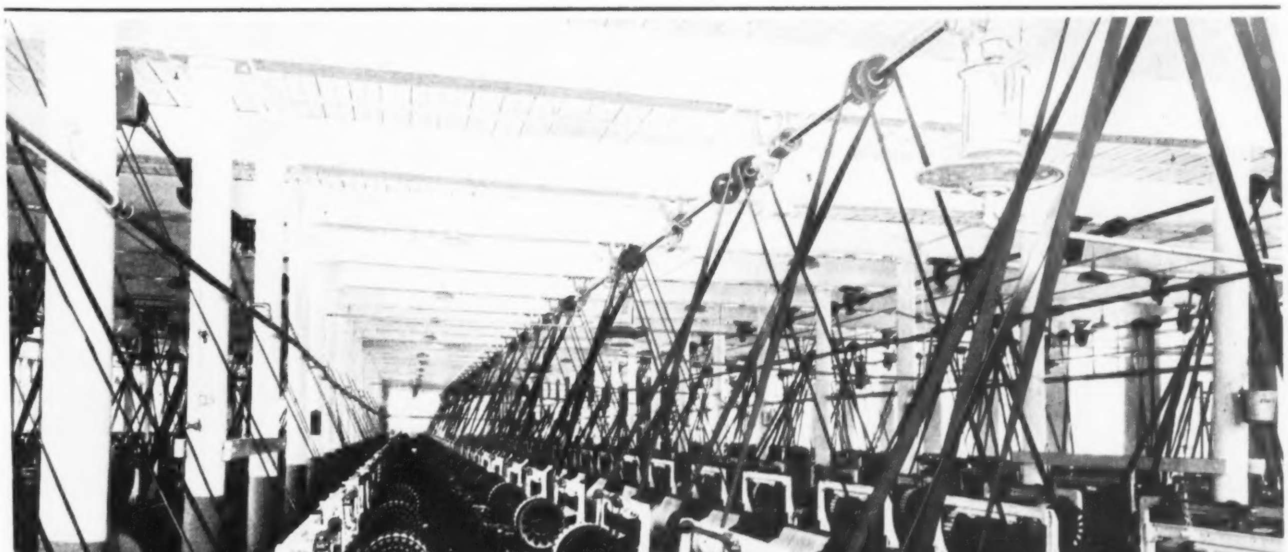


Fig. 3. White Paint for Ceilings, Walls, and Columns, as well as for the Machine Frames, Gives a Light Cheerful Appearance to the Interior of a Comparatively Old Building

For example, if we have a machine that is painted black, what color handles will show up most clearly against the black; or if the machine were painted green, what color would be most effective to provide visibility against a green background? In daylight, the order of legibility of two colors—one upon the background of the other—is indicated by the order of the numbers below. It may be of interest to note that black on white takes the sixth place, and white on black the tenth.

1. Black on Yellow
2. Green on White
3. Red on White
4. Blue on White
5. White on Blue
6. Black on White
7. Yellow on Black
8. White on Red
9. White on Green
10. White on Black
11. Red on Yellow
12. Green on Red

The reduction in unit costs made possible through paint and color properly applied deserves the consideration of manufacturers and plant managers. The advanced maintenance practice of painting the walls and ceilings in light colors has not been brought out in this article, but is of the greatest importance in obtaining satisfactory illumination. Advice on the subject is readily available from leading paint manufacturers.

Traveling Exhibit of General Electric Switch-Gear Equipment

Working models of oil-blast circuit-breakers and various types of recently developed switch-gear are being featured in a traveling exhibit sponsored by the General Electric Co. This exhibit, which provides a practical demonstration of the advantages of modern circuit-interrupting apparatus, will be shown to leading central-station, industrial, and transportation executives in key cities throughout the country. The exhibit was officially opened at the Hotel Ambassador in New York City on May 3.

The exhibit places particular emphasis on the oil-blast principle of circuit interruption in oil circuit-breaker construction; on silver contacts; and on modern arc-quenching devices used in air circuit-breaker designs. It demonstrates highly effective means of reducing the time involved in arc interruption, and shows how demands for more compact equipment have been met during recent years. Models of large metal-clad equipment are utilized to show how safety and convenience are provided through mechanical interlocking and factory assembled units.

Early Development of Cylindrical Grinding Machines

A Few Notes on the Early Development of Grinding Methods and Grinding Machines, as Related by a Pioneer in Grinding Practice

By CHARLES H. NORTON
Norton Co., Worcester, Mass.
(From the "Norton Spirit")

AWAY back in 1870, when I was nineteen years old, I worked in the machine room of the Seth Thomas Clock Co. My uncle, Noah Norton, was designing a pinion drilling machine. To secure more perfect high-speed spindles, he attempted to grind them. The spindles to be ground were about 12 inches long and 1/2 inch in diameter. He planned an attachment provided with a 4-inch emery wheel, about 1/4 inch thick, to be used on the engine lathe that I operated.

He placed the little wheel-head he had made on the lathe carriage in place of the toolpost, and explained to me how he wanted the spindles ground. I was proud to be entrusted with such new precision work. But, alas, when the grinding began, the little spindle would not remain straight, but bent until it was ground on one side only. In less than five minutes, the spindle was spoiled.

My uncle said that I was "bearing on too hard." He pushed me aside, placed another spindle on the centers, and proceeded to grind. But he spoiled that spindle in an even shorter time than I had mine. "Well," he said, "we do not know all there is to be known about this, do we? See if you can figure it out." And he walked away and left me with the six spindles, two of them already spoiled. I concluded then that to be sure to save the four remaining spindles I must try to obtain the perfection desired in some other way. I tried lapping them after filing. My uncle complimented me when he saw and measured the work; but he never learned in his day the cause of our failure to obtain results by grinding. Later he ordered a Brown & Sharpe universal grinding machine; but even with that machine, there was for several years the same warping of slim work.

At my uncle's death, I was made superintendent of machinery and tower clocks. It was then, in

1883, that I solved the old difficulty by letting a stream of water flow on slender work. I wrote, at that time, an explanation of the warping or bending of slim work when grinding, and of its prevention by the use of a stream of water.

One day I thought that perhaps sodium carbonate dissolved in water might prevent the rusting of the machine and found that it was satisfactory. Later, I learned that Brown & Sharpe painted their grinding machines with a thick grease to prevent rusting. I found them following that practice when I went with them in 1886.

It was my interest in cylindrical grinding that led to my application for a job with the Brown & Sharpe Mfg. Co. For several years previous to going to Providence, I had dreamed of such a grinding machine as later developed into the Norton grinder, a machine that would save labor and secure greater precision. At the Brown & Sharpe plant at that time, suggestions for new developments were submitted to a conference of foremen and executives. To this conference I advanced the theory that though a grinding wheel removed metal in microscopic particles, yet, with a wheel of greater circumference and greater width than had formerly been used, considerable metal could be removed, because it would be possible to remove from 6000 to 10,000 of those small particles at each revolution of the wheel, or from 12,000,000 to 20,000,000 particles a minute.

I further stated that such grinding would produce a smooth surface because the removed particles were so minute. This would make it unnecessary to turn smoothly or to close limits; the accuracy would be taken care of by grinding. My ideas, however, were considered to be impractical and I decided to await my opportunity.

It was a little later that Henry M. Leland asked me to come with him to Detroit to start a machine tool company. At first I declined, but later I joined him and his partners in this venture. I then thought that I saw my way open to bring out the grinding machine of my dreams; but when I began to work on the design, I was again faced with my partner's opposition.

After about four years, I retired from the Leland firm and tried to obtain capital in Detroit to build my grinding machine. I remember with great appreciation the kindness of the chief engineer of the Michigan Stove Co. who attempted to raise the capital for me, but his efforts did not meet with success. After a year in a patent attorney's office reading patent law, I returned to Brown & Sharpe in Providence.

It was four years later that I approached Mr. Allen of Worcester. From that meeting came my connection with the Norton Co. and the development of the cylindrical grinding machine as sponsored by that company. From that time on, the development of grinding machines and grinding practice is more recent history.

My early failures in finding someone to sponsor my efforts to design a cylindrical grinding machine I now consider a great help toward success. Time is required for the development of everything of value in this world. Had I been permitted to try to build my machine at the time of my early conception, I feel sure that it would have been a failure. Through added experience, it was possible to make the first machine successful, so that upon it could be built a great industry.

* * *

Forty-three years ago a science lecturer said that all great discoveries in physics probably had been made. A year later the X-ray was discovered.—*Factory Management and Maintenance*

Welding the Dash to the Outer Shroud of Fisher Automobile Body Front-end Assemblies. Two Shrouds are Welded at the Same Time on This Special Welding Equipment, which is Installed in the Grand Rapids Stamping Division Plant of General Motors Corporation

General Electric Stages Machine Tool Speed Show

THE General Electric Co., Schenectady, N. Y., during the past month has held three exhibits in machine tool centers, of motors and control equipment used in connection with the operation of machine tools. The exhibits, known as the General Electric Machine Tool Speed Show, were held in Worcester, Mass., May 17; Cincinnati, Ohio, May 24; and Rockford, Ill., May 28. In conjunction with these exhibits, technical sessions were held, at which papers were read relating to the application of electrical equipment to machine tools.

The exceptionally well staged shows included the presentation of motion pictures, a stage performance in "three acts" illustrating the value of cooperation between the machine tool and the electrical industry, and an exhibit of motors, controls, switches, etc.

At the Worcester meeting, a motion picture was shown, indicating the economic importance of machine tools in this age of speed. A paper entitled "High Production Performance with Carboloy Tools" was then presented by A. A. Merry of the Carboloy Co., Detroit, Mich., who gave a detailed account of the performance possibilities of carbide tools when used in connection with modern machine tools.

Then followed an address by A. C. Danekind, of the General Electric Co., dealing with the fundamental changes that have taken place during recent years in industry, emphasizing both their mechanical and economic aspects. He particularly stressed the fact that the automotive industry has practically revolutionized machine tool design in many of its branches. The automobile required better machine tools for producing accurately at speeds never before heard of. It also demanded machines that could be operated easily by comparatively unskilled men, setting as its standard the motto, "Mass Production with Tool-room Accuracy."

The result has been, for the automobile industry, better, cheaper, and sturdier cars, and for the machine tool industry, an entirely new viewpoint as to the requirements for accuracy, speed, sturdiness, and reliability in machines of the production type. "All in all," said Mr. Danekind, "the result for industry at large has been a better product at a cheaper price, with greater production accompanied by higher wages."

Mr. Danekind asked the machine tool industry to make an effort to use standard rather than special motors. "It has been noted," he said, "that an

ever-increasing number of special motors are appearing in recent machine tool designs. While the use of these motors is confined for the most part to fractional sizes that are used for auxiliary purposes, there are any number of examples where a motor conforming to the N.E.M.A. standards might have been applied. Mechanical rather than electrical limitations are apparently the designer's justification for selecting special motors. All too often, however, cooperation with a capable electrical application engineer might have overcome the necessity of using highly special electric equipment." Mr. Danekind emphasized that builders, as well as users, of machine tools have every reason to prefer equipment operated by standard motors. He also stressed the importance of cooperation between the electrical application engineer and the machine designer throughout the design of all new machine tools requiring electrical equipment.

A. C. Danekind of the General Electric Co., who Spoke at the Worcester Machine Tool Speed Show

The first objective of a machine tool designer is to produce equipment that provides for increased output, ease of operation, and low-cost maintenance, combined with simplicity of construction. Electrical rather than mechanical contrivances for driving and controlling the machine are definitely a more satisfactory means to that end. Electric equipment today represents a very substantial part of the total cost of a machine, and hence the mechanical design problems require judicious application of motors, controls, and accessories.

The subject of motors was dealt with in a paper by R. S. Walsh, of the Motor Division of the General Electric Co., and industrial controls by N. L. Hadley, of the Industrial Control Section of the company. W. R. King, of the Machinery Manufacturing Section, spoke on "How Application Engineering of Electric Apparatus Helps the Manufacturer to Obtain Speed with Accuracy," while J. D. Wright, assistant manager of the Industrial Department, spoke on "Standardization of Motors and Electrical Equipment."

At a dinner following the Worcester meeting, Clayton R. Burt, president of the Niles-Bement-Pond Co. and president of the National Machine Tool Builders' Association, was the principal speaker. He emphasized the aid of electrical equipment in the development of machine tools and urged greater cooperation between the two industries.

About 125 Machine Tool Manufacturers and Engineers were Present at the Worcester Show May 17

Machine Tool Builders' Meeting in Chicago

THE thirty-fifth annual spring meeting of the National Machine Tool Builders' Association, held in Chicago May 3 and 4 at the Edgewater Beach Hotel, was marked by several outstanding addresses on current industrial problems. In his opening address, "Machine Tools an Important Factor in American Prosperity," Clayton R. Burt, president of the Association, pointed out that the machine tool is the basic machine, producing all other machines, which, in turn, produce consumer goods. He reviewed the business and economical situation and stated that the prosperity of the country "rests squarely upon the maintenance of a sound and prosperous machine tool industry. Any restrictions, economic or political, that divert the attention of the machine tool builder from his primary function of designing and supplying industrial equipment are a drag upon progress."

Tell Berna, general manager of the Association, gave a comprehensive review of the activities in the industry. He emphasized the growing scarcity of skilled mechanics and the increasing interest in apprentice training, especially pointing to the need for cooperative efforts in this respect between the smaller manufacturers in a community. He also called attention to the need for educational effort among the general public to accentuate the value of the industry to the country as a whole.

"Practical Aspects of Depreciation" was the subject of an address by J. K. Mathieson of Mathieson, Aitken & Co., Philadelphia, Pa. Mr. Mathieson emphasized the importance of a sufficient depreciation charge to recover the cost of equipment in the selling price of a product. If every manufacturer would consider depreciation as if he paid rent for the equipment he uses, then not only would he be sure to add depreciation to his costs, but he would also have an opportunity to set aside the actual amount charged to depreciation in a replacement fund, to be used for buying new equipment as the old becomes obsolete. In discussing this paper, R. E. W. Harrison, vice-president of the Chambersburg Engineering Co., Chambersburg, Pa., brought out important points on depreciation procedure.

In an address containing many constructive suggestions, Howard W. Dunbar, vice-president of the Norton Co., Worcester, Mass., dealt with the mutual problems of machine tool builders and dealers. The discussion was further amplified by J. Roy Porter, president of the Marshall & Huschart Machinery Co., Chicago, Ill.

"What Machinery Has Done to Mankind" was the subject of an address by Dr. James S. Thomas, president of the Clarkson College of Technology, Potsdam, N. Y., and of the Chrysler Institute of Engineering, Detroit, Mich. Dr. Thomas, in an address filled with specific facts, showed how the standard of living in the United States is directly proportional to the amount of production machinery being used here. In an equally factual address entitled "A Study of the Business Structure and a Long Look Ahead," Franklyn Hobbs, a well-known economist, dealt with the economic problems of the day and predicted an all-time high (up to that time) of production of American industry in 1939.

"Present Trends in Shop Management" was the subject of an address by C. S. Craigmile, works manager of the Belden Co., Chicago, Ill. To show the importance of production, he said:

"Suppose we conceive of all the products of industry and agriculture in the United States as placed in one great pile. What is in that pile is all there is to be divided by the one hundred and thirty millions of people that live here. How can the share of each be increased? Obviously, only by increasing the size of the pile. Now, can this pile be increased by doing less work and producing less? Obviously not. It is more work and more production that will make the pile bigger; and when the pile is bigger, there is more to be divided. Able management, high-grade machine equipment, and efficient labor will increase the size of the pile. The share of each will be greater. Poor management, old and obsolete machinery, labor disturbances, and inefficiency of labor will decrease the size of the pile. The share of each will be less."

One of the high lights of the meeting was the address, "Industry and Society," by W. J. Cameron of the Ford Motor Co., well known for his talks over the Ford Sunday evening radio hour. Mr. Cameron emphasized that social improvements in industry never have been caused solely by outside force or pressure; nor have social advances ever originated with any government or labor leaders. Improvements have originated with progressive and enlightened leaders in industry, and have then been taken up by other agencies to force their universal acceptance in less progressive businesses. The desirable things that have been fought for in strikes, for example, have always been those things that were first shown to be possible by forward-looking industrialists. He illustrated these points by specific references to how advanced labor legislation in England a century ago was advocated by employers in the very fields where abuses existed, and how higher American wage standards today were established by some employers long before labor unions made demands for these standards.

Scrapping Equipment Worth $175,000,000

Recently, W. J. Cameron, Speaking on the Ford Sunday Evening Radio Hour, Emphasized the Effect of Replacing Obsolete Equipment by Up-to-Date Machinery. His Address is Published Here

THE American workman is the highest priced workman in the world because American management has furnished him with the best working equipment in the world. The American workman earns more money, owns more property, uses more goods, and is able to save more by his thrift than any other, not because he works harder or works longer hours—he is very far from doing either of these—but because his better equipment under expert direction enables him to produce more. In ordinary work, no other method can command a high price. The very best of workmen could not do it without the best equipment and the best possible organization of work. You have merely to look where the best tools and best methods are *not* used to find where good wages are *not* paid.

Of course, to equip people to earn good wages costs a lot of money; that is why it is not done everywhere. Money-minded managers find it too expensive. Progressive managers discovered long ago that it is cheap labor that costs most, and expensively equipped and highly paid labor is in every way the most economical to employ.

At the present stage of industrial development, we have definitely passed the point where men can earn more simply by working longer and harder—improvement does not come that way these days; it comes solely by enhancing individual usefulness through modern tools and efficient management of work.

To illustrate this: In the last eight years (seven of which were deep depression years) the Ford Motor Co. scrapped 46 per cent of its entire plant. The actual value involved was $175,000,000. And most of the machines scrapped were in excellent condition, measuring up to the standards by which, at that very time, the Ford Motor Co. was ranked as being the most modern manufacturing plant in the world. A concern mainly intent on money could have kept that equipment in service for years to come. Many antiquated plants exist whose out-of-date machinery and methods are a heavy charge on the public year in and year out.

The equipment scrapped was not worn out or broken, nor obsolete in the ordinary sense. The power plant, $20,000,000 worth of which was scrapped, was as good as the day it was built—maybe better—but a more economical system of making power had arrived.

Now, this $175,000,000 worth of scrapped equipment was replaced during the same eight years with $217,000,000 worth of new equipment—which averages an expenditure of $2,250,000 a month for the ninety-six months. People of no business experience and obsessed by an exaggerated notion of the dollar—that is, money-minded people—would declare this a grievous waste. It was not waste—it was economy—it was a great saving. Had the company been money-minded and "saved" that $217,000,000 by replacing little or nothing during those eight years, the public would literally have lost it. By the public, we mean everyone who has any connection with the company, everyone who sells it materials, everyone who buys its product, everyone who works for it.

Each of these groups would have paid its full share of that $217,000,000 for the industrial backwardness and bad management—the indolent, unprogressive management that had refused to improve the plant. The company itself would have paid heavily in loss of efficiency, the public would have paid in decreased car values or higher prices, and the wage-earner would have paid in less employment and lower wages. Bad management is always a charge against the public; good management is always a contribution to the public.

When that $175,000,000 of scrapped equipment was replaced by $217,000,000 worth of new installations, this sum necessarily found its way into American industry and provided work and wages for men other than our own—from miners to machine tool builders. What it did for our own men was this: It gave them a blanket wage increase of a dollar a day during two years of the depression; they were the last in large industry to feel unemployment or wage cuts; they were the first in large industry to come back to the full minimum wage rate; it secured for them last year 100,000 individual wage increases, which amounted to about $141 a man; and it resulted last year in a total payroll increase of $45,000,000, maintaining Ford wages the highest in the industry.

This is the vital connection that exists between management and employment. But in spending money there is this difference; every dollar spent, even by mismanaged industry, goes for wages somewhere, because all industrial payments are reduced to wages at last; but the dollar spent by a wisely managed industry, spent to acquire better methods and machines, does something more than merely maintain present values and wages, it creates *higher* values for customer and *higher* wages for worker. And it is the only method that does or can.

Building the Mounting for World's Largest Precision Instrument

A TELESCOPE with a mirror 200 inches in diameter—twice the size of the largest telescope in the world at the present time—is being built for erection on a 6000-foot mountain peak in California. When this telescope is finished, astronomers will be able to observe heavenly bodies one billion light years distant, whereas at present, they can see only one-half that far. The telescope will bring the moon apparently within twenty-four miles of the earth. The weight of the complete telescope will be approximately 1,000,000 pounds, and the over-all height, with the tube vertical, will be 75 feet.

Engineering ability of the highest order was required in designing the huge mounting for this telescope to provide means for carrying the various loads in a manner that will insure the accuracy demanded. The instrument had to be so designed that it will be possible to observe any point in the sky from the polar star to the southern horizon and from the eastern to the western horizon. In order to reach the region around the star Polaris, it was necessary to make the upper end of the telescope yoke in the shape of a horseshoe. This horseshoe has a bearing surface 46 feet in diameter by 54 inches in width, which is probably the largest journal bearing ever constructed. Bearing pads of ingenious design support the horseshoe at two points on a film of oil that is maintained at a pressure of 300 pounds per square inch. At the opposite end of the instrument, a large spherical oil bearing carries a thrust load of 580,000 pounds and a lateral load of 350,000 pounds. Because of the unique construction of the bearings, only about 1/15 horsepower is required to operate the huge telescope yoke.

The mounting for this telescope is being fabricated at the South Philadelphia Works of the Westinghouse Electric & Mfg. Co. by arc-welding mild steel plates and structural shapes and a few steel

Fig. 1. Early Stages in the Fabrication of One Section of the Yoke Horseshoe. The Outer Plate is 54 Inches Wide by 4 1/2 Inches Thick and has been Rolled to a Diameter of About 46 Feet

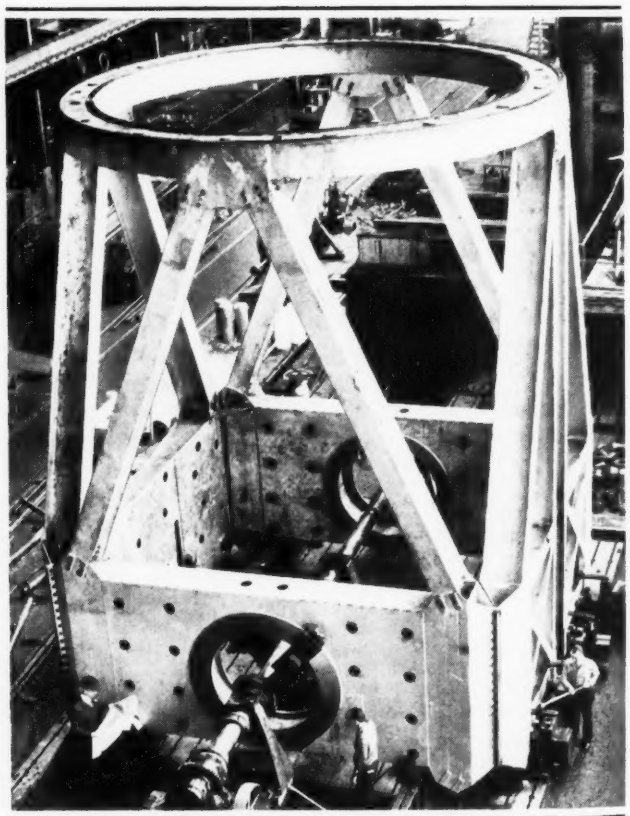
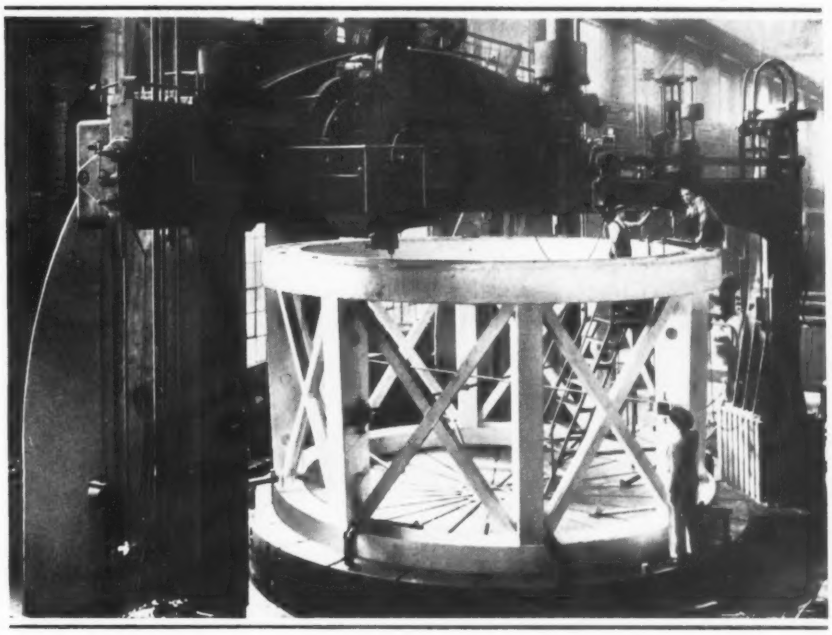


Fig. 2. Boring the Main Section of the Tube to Receive the Bearing Gimbals. The Bores Have a Diameter of 60 and 66 Inches, Respectively. The Maximum Driving Length of the Bar is 26 Feet

Fig. 3. Machining a Joint of the Prime Focus Cage on a 32-foot Boring Mill. The Radial Drilling Machine was Used for Drilling Bolt Holes in the Lower Ring of the Cage to Accurate Center Distances



forgings. An early stage in the fabrication of one section of the horseshoe yoke is shown in Fig. 1. The large dimensions of the heavy inner and outer plates will be apparent from a comparison with the height of the men. The plates are 4 and 4 1/2 inches thick, respectively. All of the welded sections must be annealed; and because of the size of some of them, it was necessary to construct a special annealing furnace. The different sections are doweled and will be bolted together on the site where the telescope is to be erected. Precise machining operations are necessary to insure accurate assembly.

Two annular bearing surfaces, 3 1/2 inches wide, were machined on the lower surface of the tube bottom ring in the operation illustrated in Fig. 3, by the use of a 32-foot boring mill. The inner bearing surface had to be provided with a keyway 1 1/2 inches wide to fit a sectional key assembled in a similar keyway cut in the top ring of the tube. Bolt holes were drilled to accurate center distances around this section by means of a radial drilling machine set up beside the boring mill, as seen in Fig. 3.

When erected, the weight of the telescope will be carried by flexible gimbals, bolted to a hollow spindle that will rotate in large ball bearings. Bores 60 and 66 inches in diameter had to be machined in opposite panels of the tube section shown in Fig. 2, to receive the gimbals. For this operation, use was made of a 10-inch boring-bar having a screw feed. This boring-bar was set up on three pedestals, one in the center of the tube and one outside of each panel. The maximum driving length of the bar was about 26 feet; and because of its tendency to sag under its own weight and that of the boring head a lathe steadyrest had to be provided close to the boring head. Also, to prevent chatter due to the torsional deflection in a bar of this length, only light cuts could be taken.

Carboloy Film Shows Rapid Grinding Methods

Supplementing the grinding demonstrations held during 1936, the Carboloy Co., Inc., 2987 E. Jefferson Ave., Detroit, Mich., has recently released a sound slide film showing the company's new rapid technique for grinding Carboloy tools This film has already been shown to several thousand people.

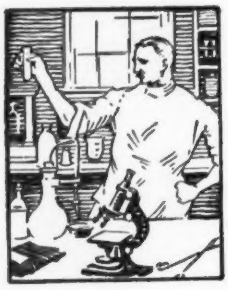
The film shows correct and incorrect methods of grinding tools and the proper equipment for correct grinding. It is of interest not only to tool-grinding operators, but also, because of the economies clearly indicated, to production and administrative executives. The film will be made available to engineering societies, foremen's clubs, purchasing agents' associations, and others interested in the grinding of carbide tools. Requests for the film should be sent to the Carboloy Co., Inc., at the address given above.

* * *

New Standard for Machine Tapers Approved

The American Standards Association, 29 W. 39th St., New York City, has published an American Standard for Machine Tapers (Self-Holding Taper Series) as approved by the Association March, 1937. These tapers which are based partly upon the Brown & Sharpe taper series, partly upon the Morse taper series, and partly upon added sizes, are sponsored by the American Society of Mechanical Engineers, the National Machine Tool Builders' Association, and the Society of Automotive Engineers. A publication entitled "Machine Tapers," giving full information about the new standard tapers, can be obtained from the American Standards Association. The price is 50 cents.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Solid Dies of Nickel Cast Iron Used for Automotive Stampings

Automobile fenders, hoods, running boards, etc., totalling over 3,000,000 pieces were produced during 1936 by the Oshawa plant of General Motors of Canada, Ltd. In addition, many other stampings, such as hub caps and miscellaneous accessory parts, were stamped and drawn. The presses that produced these steel pieces, according to the *Nickel Cast Iron News*, published by the International Nickel Co., Inc., are equipped with dies made from the nickel-alloy cast iron known as "Domite." This is a product of the Dominion Wheel & Foundry Co., Toronto, Canada, in which the percentages of nickel and other alloying elements are varied to meet specific requirements.

In most instances, it is possible to cast dies to such close dimensions that the male and female units will fit within small fractions of an inch even before being filed. Final clearances must be between 0.001 and 0.0015 inch. Dies cast from Domite have been found to produce 30,000 stampings and more before redressing is necessary.

Nickel Cast-iron Dies Used for Forming Chevrolet Fenders

Before making the dies from nickel-iron castings, they were ordinary gray-iron castings provided with inserts of tool steel where wear had to be resisted. This necessitated much more machine work than is now required. In making dies for new car models, 9000 hours of labor were formerly charged in the shop to diemaking, whereas with Domite dies, the average shop labor is said to amount to only 3800 hours.

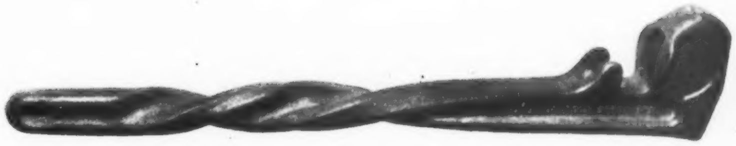
Bakelite Impact-Resistant Molding Materials

Many parts molded from plastic materials must possess greater resistance to shock or impact than is afforded by general-purpose molding materials, because of the conditions under which they are used. In order to meet varied impact-strength requirements, the Bakelite Corporation, New York City, has developed a new line of molding materials with which from 0.22 to 2 foot-pounds of energy is required to break an A S T M standard test specimen (2.75 to 25 foot-pounds per square inch).

Generally speaking, these molding materials are classified as improved impact, medium impact, medium-high impact, and high impact. In each classification, there are now two or more molding materials. They possess, in addition to impact resistance, chemical and water resistance and dielectric properties.

The new molding materials are particularly suitable for hand-set telephones, golf club heads, football-shoe cleats, instrument cases, junction boxes, oil-well equipment, rayon spinning buckets,

Wrench Handle of Malleable Iron Containing 0.35 Per Cent Molybdenum, Twisted through 360 Degrees. Handles Made from the Same Material have been Twisted 450 Degrees (One and a Quarter Turns) without Breaking. (Photo, Courtesy Climax Molybdenum Company)



and other molded parts that are used under conditions where relatively high impact or shock resistance is required.

Stainless and Heat-Resisting Steel Castings

A complete line of Silcrome stainless and heat-resisting steel castings is now available as a result of research conducted by the Ludlum Steel Co., Watervliet, N. Y., a pioneer in the manufacture of straight chromium and 18-8 types of stainless and heat-resisting steels in bar, sheet, strip, and wire form. The new development is the result of an extensive series of experiments which have demonstrated that stainless and heat-resisting steel castings can be produced with a wide range of controllable analyses, having excellent physical characteristics and very good corrosion resistance; these castings are unusually free from porosity, and generally meet the demands made upon stainless and heat-resisting steels. The development makes use of the hollow electrode type of electric steel-melting furnace, which is a furnace of the indirect arc type with rotating hollow, horizontal graphite electrodes, inclined slightly toward the arc, which impinges on the bath, although the bath does not become part of the arc circuit.

Practically all alloy specifications containing 10 per cent or more of chromium are produced. The principal types are: Chromium 18, nickel 8 per cent; chromium 20, nickel 10 per cent; chromium 18, nickel, 0.5 per cent; chromium 18, nickel 2 per cent; chromium 12, nickel 2 per cent; chromium 25, nickel 12 per cent; chromium 25, nickel 20 per cent; chromium 15, nickel 35 per cent.

Stainless steel castings made from metal melted in the hollow electrode furnace, especially when there has been no attempt to eliminate the oxides of chromium from the bath, possess very good machining characteristics. For example, in the experiments, cutting speeds of from 55 to 140 feet per minute were used successfully with feeds as high as 1 3/8 inches per minute and depths of cuts up to 1/16 inch.

The corrosion resistance is also very good. Samples exposed to atmospheric attack in the vicinity of Watervliet have shown no effects from rusting, pitting, or anodic type of corrosive attack after thirteen months' time.

To summarize: The hollow electrode furnace method of making stainless and heat-resisting steel castings permits very accurate control of chemical analyses, especially for carbon; produces castings with better machining qualities than ordinarily found in similar products from metal melted in the usual type of electric furnace; results in freedom from porosity and sand holes, good salt spray and atmospheric corrosion resistance in the "as cast" condition, and after heat-treatment, marked resistance even to mixed acids.

Results Obtained by Alloying Tin with Germanium and Beryllium

Investigations conducted by the International Tin Research and Development Council to determine the effects of adding germanium and beryllium to tin indicate that the addition of 0.35 per cent germanium to tin increases the Brinell hardness approximately 100 per cent, decreases the ductility 20 per cent, and decreases the bending strength 50 per cent. The addition of 0.2 per cent beryllium to tin increases the hardness very slightly, reduces the ductility 20 per cent, and slightly improves the bending strength. The influence of small amounts of antimony, bismuth, lead, electrolytic and refined zinc, and arsenic on the hardness, ductility, and bending strength of tin has also been determined. This investigation has been conducted at the Institut für Angewandte Metallkunde in Berlin, Germany. A description of the results is given in a pamphlet which is obtainable from L. J. Tavener, 149 Broadway, New York.

Rubber Machine Mountings Counteract Shock Vibrations

When heavy presses and similar equipment are operated in a shop, the shocks transmitted through the floor to other machines may be great enough to affect the accuracy of the operations performed by those machines. With a view to overcoming such floor vibration, the Timken Roller Bearing Co., Canton, Ohio, has installed grinding machines, motors, laboratory equipment, etc., on the rubber-to-metal mountings known as Vibro-Insulators which are made by the B. F. Goodrich Co., Akron, Ohio. Equipment that has been rubber-mounted in this manner is completely insulated from floor vibration.

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer

Grinding Wheels

ABRASIVE CO. DIVISION OF SIMONDS SAW & STEEL CO., Tacony and Fraley Sts., Philadelphia, Pa. Grinding Wheel Data Book, containing complete instructions for the users of grinding wheels, covering types of cutting particles and bonds; standard types, shapes, and sizes of grinding wheels; applications and uses of wheels; complete grinding wheel selection table for various materials and classes of work; tables of wheel and work speeds; and other allied information.

Speed Control Equipment

REEVES PULLEY CO., Columbus, Ind. New edition of Speed Control Handbook, containing 118 pages covering the complete line of Reeves speed control equipment, including variable-speed transmissions, "Vari-Speed" motor pulleys, and "Vari-Speed Motodrives." Specific applications of variable-speed control in many of the major industries are shown. The book also contains engineering information, including new revised speed and horsepower tables.

Twist Drills

WHITMAN & BARNES, INC., Detroit, Mich. Decimal equivalent and tap drill size wall chart, giving nominal and decimal dimensions for all standard drills from 1/64 to 1 inch in diameter, inclusive, as well as letter size and wire size drills. In addition, the chart also gives national standard tap drill sizes in both fine and coarse thread. These charts should be of value in engineering and drafting-rooms, machine shops, tool-rooms, etc.

Steels

TIMKEN ROLLER BEARING CO., Steel and Tube Division, Canton, Ohio. Technical bulletin No. 10, giving the results of oxidation tests at 1000 degrees F., 1250 degrees F., and 1500 degrees F., of thirteen different alloy steels. Folder on graphitic steel, a new steel for tools and dies, produced for water hardening uses under the name "Graph-sil," and for oil hardening uses under the name "Graph-mo."

Grinding Wheels

NORTON CO., Worcester, Mass. Circular entitled "Your Disk Grinder—What Type Disk Wheel?" picturing eight different disk grinding jobs, each requiring its own particular combination of abrasive and bond, grain, grade, and structure. The circular also gives recommendations for the correct disk wheel to use on many different classes of work and various materials.

Ball Bearings

NEW DEPARTURE DIVISION of the GENERAL MOTORS CORPORATION, Bristol, Conn. Booklet S, covering the complete line of New Departure ball bearings. In addition to the up-to-date listing of all available types, sizes, and list prices, interesting sections are included on bearing selection, mounting directions, fits and tolerances, and equivalent bearing tables.

Welding Equipment

HARNISCHFEGER CORPORATION, 4536 W. National Ave., Milwaukee, Wis. Bulletin W10, entitled "The Arc Welding of Tomorrow," pointing out the advantages gained by the internally stabilized arc. The illustrations show the many uses of the various Smootharc welding machines, from the vertical 75- and 100-ampere types to the 200-, 300-, 400-, and 600-ampere horizontal models.

Belt Conveyors

CHAIN BELT CO., Milwaukee, Wis. Catalogue 270, covering the Rex line of belt conveyors. In addition to showing various applications of these conveyors, the book contains data of value to the designing engineer and belt conveyor user, including charts and tables for selecting the proper unit to meet any particular requirement.

Cold-Drawn Steel

UNION DRAWN STEEL CO., Massillon, Ohio. Circular entitled "The Union Drawn Representative Serves the Mutual Interests of His Customers and His Company," briefly describing the service offered by the company to its customers in helping them to make the proper selection of steel and fabricating processes.

Roller Chain and Sprockets

DIAMOND CHAIN & MFG. CO., Indianapolis, Ind. Catalogue 607, containing complete data, including prices, on standard roller chains ranging from 3/8- to 2-inch pitch, as well as on stock and made-to-order sprockets. The information covers power transmission capacities and chain selections for the usual drives.

Ball Bearings

FAFNIR BEARING CO., New Britain, Conn. Circular entitled "Plain Bearing Motors Saved," describing how plain bearing motors that are inefficient in operation can be easily converted into the ball bearing type by the application of the Fafnir wide inner-ring ball-bearing motor cartridge.

Conveying Equipment

BALDWIN-DUCKWORTH CHAIN CORPORATION, Springfield, Mass. Booklet entitled "Conveying Equipment for High Temperatures," outlining the solution of a conveyor problem where material had to be carried through an annealing furnace in which the temperature was 1400 degrees F.

Stainless Steel

REPUBLIC STEEL CORPORATION, Cleveland, Ohio. Booklet 180, entitled "The Welding of Enduro Stainless Steel," describing in detail the proper methods of welding stainless steel by electric arc, gas, seam, spot, projec-

tion and atomic hydrogen methods. Information is included on brazing and silver soldering.

Indicating and Recording Equipment

BROWN INSTRUMENT CO., Wayne and Roberts Aves., Philadelphia, Pa. Catalogue 3005, covering the complete line of Brown indicating and recording carbon-dioxide meters, as well as the combined carbon-dioxide and flue gas temperature recorders.

Ball Bearings

MARLIN-ROCKWELL CORPORATION, Jamestown, N. Y., is publishing a series of sixteen bulletins for the shop man covering ball bearing practices. These bulletins contain information on the construction, care, assembly and removal, housing, and lubrication of ball bearings.

Portable Electric Tools

BLACK & DECKER MFG. CO., 735 Pennsylvania Ave., Towson, Md. Catalogue covering the Black & Decker line of portable electric tools, including drills, drill stands, saws, grinders, heat guns, valve refacers and valve seat grinders, surfacers, sanders, screwdrivers, etc.

Gears

D. O. JAMES MFG. CO., 1120 W. Monroe St., Chicago, Ill. Circular showing some of the many types of gears made by this concern, including spur, straight and spiral bevel gears, worm-gears, internal gears, helical and herringbone gears, sprocket wheels, racks, etc.

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Circulars GEA-821F, 2404A, and 2603, illustrating and describing, respectively, pressure and vacuum switches of the diaphragm type; two-element single-disk watthour meters; and indoor oil-blast circuit-breakers.

Grinding Wheel Grading Machine

ABRASIVE ENGINEERING CORPORATION, Detroit, Mich. Bulletin illustrating and describing the Grade-O-Meter, an instrument for mechanically testing the strength of the bond of grinding wheels, honing stones, etc.

Valves and Fittings

WALWORTH CO., 60 E. 42nd St., New York City, is publishing a bi-monthly magazine entitled "Walworth Today," illustrating outstanding developments in valves, fittings, pipe, and tools. The first issue, May, 1937, contains an article on "Creep Testing of Metals."

Heat-Treating Equipment

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Circular entitled "Saving the Threads of Alloy-Steel Parts by the Hump-Vapocarb Method," describing the hardening of threaded alloy-steel parts in a triple-control Hump electric furnace.

Milling Machines

BROWN & SHARPE MFG. CO., Providence, R. I. Circular showing various applications of the Brown & Sharpe No. 12 plain milling machine —in climb milling, in conventional milling, and in combined climb and conventional milling.

Universal Milling Attachments

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio. Bulletin M-748, illustrating and describing the Cincinnati high-speed universal milling attachment designed for application to the newer types of Cincinnati milling machines.

Diesel Engines

FAIRBANKS, MORSE & CO., 900 S. Wabash St., Chicago, Ill. Circular illustrating and describing a new Model 42-E Diesel engine, designed to meet the demand of small power users for a heavy-duty continuous-service stationary engine.

Spray Cleaning Equipment

HOMESTEAD VALVE MFG. CO., INC., Coraopolis, Pa. Bulletin illustrating a few of the many applications of the Hypressure Jenny chemical vapor spray cleaning machine in industrial plants, automotive work, and other fields.

Pulleys and Flexible Couplings

CONGRESS TOOL & DIE CO., INC., 9030 Lumpkin Ave., Detroit, Mich. Catalogue completely listing the Congress line of V-grooved pulleys, variable-speed pulleys, step-cone pulleys, and flexible couplings.

Electric Control Equipment

STRUTHERS DUNN, INC., 139 N. Juniper St., Philadelphia, Pa. Folder illustrating and briefly describing this company's line of relays, timing devices, thermostats, electric counters, melting pots, ladles, etc., and various applications.

Electric Control Equipment

ALLEN-BRADLEY CO., 1331 S. First St., Milwaukee, Wis. Bulletins containing data on the electric control apparatus made by this company, including switches, rheostats, and starters. New price sheets on this equipment, effective April 15.

Automatic Lathes

CONE AUTOMATIC MACHINE CO., INC., Windsor, Vt. Catalogues illustrating and describing the construction of the four-spindle "Conomatic," the eight-spindle "Conomatic," and the four-spindle Cone automatic machine.

Electric Regulators

IDEAL COMMUTATOR DRESSER CO., 1221 Park Ave., Sycamore, Ill. Circular describing the features and applications of the Marshall floating-carbon-pile regulators for automatic voltage, current, and speed control.

Acid and Rust Resisting Paints

SKYBRYTE CO., Cleveland, Ohio. Catalogue containing information on the better maintenance of metal, concrete, wood, glass, and composition surfaces by means of acid and rust resisting paints and enamels.

Air Compressors

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin L-621-B5, covering the Worthington line of vertical single-cylinder, single-stage, air-cooled and water-cooled compressors.

Dust Control Equipment

W. W. SLY MFG. CO., 4700 Train Ave., Cleveland, Ohio. Bulletin S-85, descriptive of dust control equipment. Circular on Sly "Purair" helmets for protecting workmen against dust, fumes, etc.

Protective Rubber Coatings

KELSAN PRODUCTS, St. Clair, Mich. Leaflet on Kelsanite permanent protective coatings, a type of removable liquid rubber coating described by the slogan "Applies Like Paint—Peels Like a Banana."

Friction Clutches

CARLYLE JOHNSON MACHINE CO., Manchester, Conn. Leaflet illustrat-

ing and describing Johnson standard type friction clutches, made in single and double types. Revised prices are included.

Steel Shelf and Shop Boxes

LYON METAL PRODUCTS, INC., Aurora, Ill. Catalogue on steel boxes and steel shelves, illustrating and describing a wide range of steel boxes for every manufacturing and storage use.

Automatic Timing Devices

M. H. RHODES, INC., 9 Rockefeller Plaza, New York City. Booklet 104, descriptive of various automatic timing devices sold under the trade name of "Mark-Time," for industrial and other uses.

Portable Crane Trucks

ELWELL-PARKER ELECTRIC CO., 4205 St. Clair Ave., Cleveland, Ohio. Bulletin describing four types of Elwell-Parker portable crane trucks ranging in capacity from 1000 to 10,000 pounds.

Adjustable Reamers

MCCROSKY TOOL CORPORATION, 1340-70 Main St., Meadville, Pa. Bulletin 15-A, containing data on McCrosky-Super adjustable reamers, including complete specifications and prices.

Cutting-Off Machines

MODERN MACHINE TOOL CO., Jackson, Mich. Circular listing different sizes of the Modern cutting-off machine, designed for cutting off tubing, pipe, and solid bar stock.

Seamless Flexible Metal Tubing

AMERICAN BRASS CO., Waterbury, Conn. Bulletin SS-3, describing the construction, applications, and typical installations of American seamless flexible metal tubing.

Drafting-Room Equipment

OZALID CORPORATION, 354 Fourth Ave., New York City. Circulars descriptive of the new Ozalid dry developing machine and Ozalid printing and developing units.

Cleaning Equipment

IDEAL COMMUTATOR DRESSER CO., 1221 Park Ave., Sycamore, Ill. Circular descriptive of the new "Super-Power" Ideal 3-in-1 cleaners for industrial and other uses.

Electric Motors

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Bulletin 3105, describing the new line of Type CS dual ventilated fan-cooled squirrel-cage motors.

Electric Motors

RELIANCE ELECTRIC & ENGINEERING CO., Ivanhoe Road, Cleveland, Ohio. Loose-leaf bulletin 305, illustrating and describing Reliance disk-brake motors.

Rust Arrester

TRUSCON LABORATORIES, Detroit, Mich. Bulletin 441, descriptive of Bar-Ox Formula 97, a rust arrester for protecting iron and steel, as well as steel paint.

Heat-Treating Equipment

SURFACE COMBUSTION CORPORATION, Toledo, Ohio. Bulletin SC-81, descriptive of malleableizing with the SC gas-fired radiant tube heating element.

Engine-Driven Welders

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Bulletin 26-150, descriptive of engine-driven welders of the single-operator type.

Motorized Speed Reducers

UNIVERSAL GEAR CORPORATION, 19th and Martindale Ave., Indianapolis, Ind. New price lists covering this company's line of universal motorized speed reducers.

Flexible Couplings

JOHN WALDRON CORPORATION, New Brunswick, N. J. Bulletin 53, illustrating and describing Francke all-steel fractional-horsepower flexible couplings.

Pebble and Ball Mills

PATTERSON FOUNDRY & MACHINE CO., East Liverpool, Ohio. Catalogue 372, descriptive of the Patterson line of pebble and ball mills for fine grinding.

Elevator Buckets

LINK-BELT CO., 2410 W. 18th St., Chicago, Ill. Folder 1435, illustrating and describing the new Link-Belt "Super Salem" steel elevator bucket.

Flexible Couplings

T. B. WOOD'S SONS CO., Chambersburg, Pa. Circular illustrating and describing universal Giant Type E flexible couplings.

New Book on Air-Conditioning

AIR-CONDITIONING IN THE HOME. By Elmer Torok, M. E. 296 pages, 6 by 9 inches; 50 illustrations and 45 tables. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York City. Price, $3.

This book is intended as a work of reference not only for engineers and architects responsible for air-conditioning installations, but also for all home owners contemplating the installation of air-conditioning systems. It explains the important advantages of air-conditioning, the fundamental principles involved, the air-conditioning equipment and systems in use, and includes an unusual amount of definite data for everyone interested either in partial or complete air-conditioning.

The exact procedure in designing typical installations is shown by specific examples, and there is a vast amount of practical designing data and general information of an original character. Simple drawings or diagrams, many of which fill an entire page, show the exact arrangement of different systems and illustrate just how different classes of air-conditioning apparatus can be combined with existing heating systems. The advantages and disadvantages of different systems are pointed out.

The important question of cost is carefully considered; this information on cost applies to various types of air-conditioning equipment, and typical cost figures are given. Most of the book is written in non-technical language, so that anyone not engaged in actual designing or installation problems can, nevertheless, acquire much useful information.

* * *

Orders received by the General Electric Co. for the first quarter of 1937 amounted to over $105,000,000, compared with slightly less than $60,000,000 for the corresponding quarter of 1936. This is an increase of 78 per cent, and represents the largest first quarter of a year in the history of the company.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

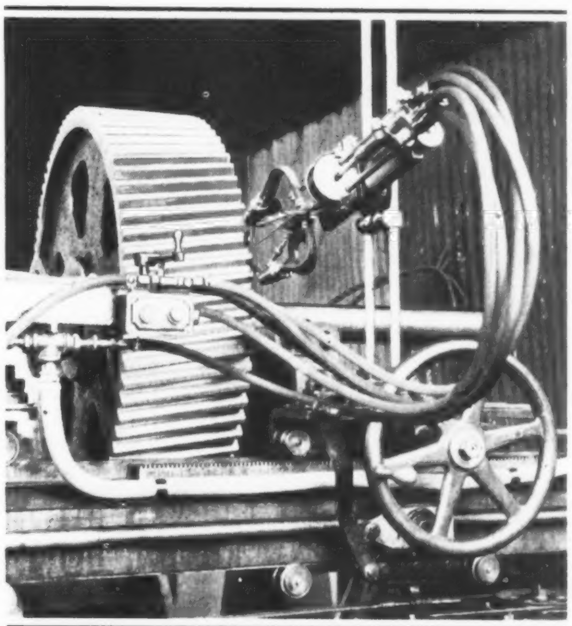


Fig. 1. Hardening Opposite Sides of a Gear Tooth by Applying Two Torches Mounted on the Same Head

Farrel-Birmingham Gear-Hardening Machine

A machine designed for hardening the teeth of double-helical or herringbone, single-helical, and spur gears by the torch or flame method is being introduced to the trade by the Farrel-Birmingham Co., Inc., 377 Vulcan St., Buffalo, N. Y. The torch-hardening method enables tooth surfaces to be hardened without appreciable distortion, and when properly carried out, is entirely successful for teeth of from 6 to 1 diametral pitch. The process can also be used for smaller teeth; however, gears with fine-pitch teeth are generally small enough in diameter to be hardened conveniently in a furnace.

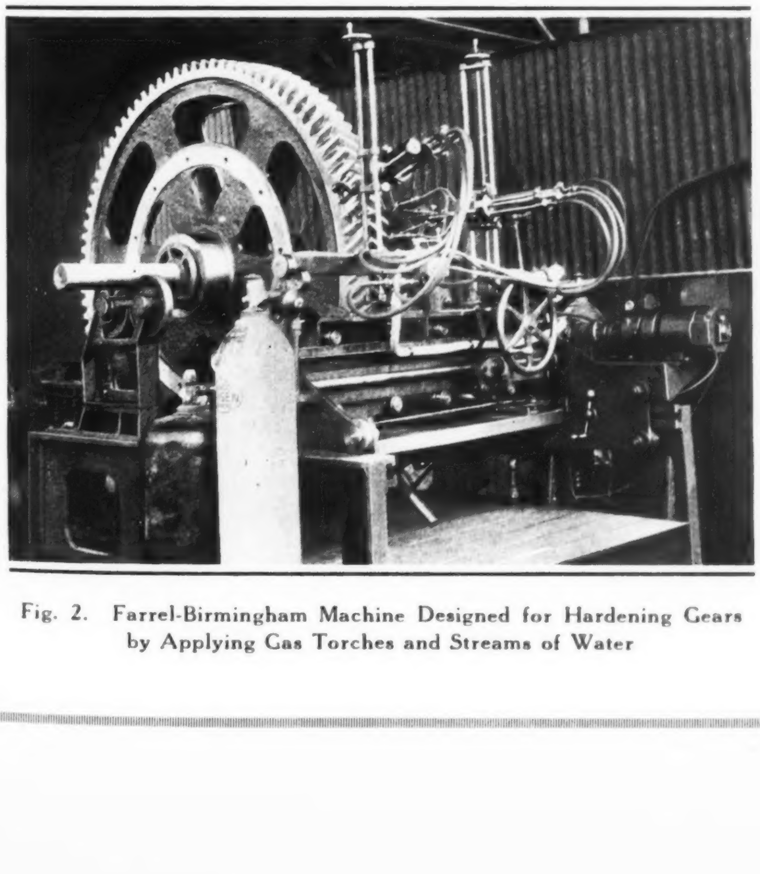


Fig. 2. Farrel-Birmingham Machine Designed for Hardening Gears by Applying Gas Torches and Streams of Water

The machine is shown being used in Fig. 2 in an operation on a large hoist gear of the herringbone type. It will be seen that the arbor carrying the gear is supported by anti-friction rollers, so arranged as to accommodate arbors or shafts varying considerably in diameter. The method of holding the work is, therefore, especially convenient.

From Fig. 1, which illustrates an operation on a single-helical gear, it will be seen that the torch head carries two sets of torches or tips, so that both sides of a gear tooth are hardened simultaneously. When a machine is set up with two heads, as illustrated in Fig. 2, both sides of two teeth are hardened at the same time. One torch head starts hardening at one end of a tooth, and the other at the opposite end. They each travel horizontally toward the center or apex of double-helical teeth. A guiding roller fixed on the torch saddle, as seen in Fig. 1, engages the gear being hardened between

two teeth, so as to rotate the gear in correct relationship with the horizontal movement of the torches.

The rate of travel of the torches and their attached water jets can be regulated by turning the handwheel of a variable-speed gear. The usual rate is from 6 to 10 inches a minute, depending upon the size of the gear teeth being hardened. Each torch head is provided with a pilot light for igniting the torches. This pilot light and the gas supply to the torches are controlled by one lever. To obtain the desired degree of hardness, depth of hardness, and uniformity, fine adjustments of the burners and the water jets are essential.

In addition to gear teeth, this machine is suitable for hardening splines, rolling-mill wabblers, sprocket wheels, and other parts. Gears up to 84 inches in diameter by 24 inches face width can be handled. The water tank which forms the base of the machine has a capacity of 250 gallons. The centrifugal motor-driven pump is provided with a relief valve, so that the water pressure is kept constant and of the correct volume, it having been found that the water pressure from city mains may not be sufficiently uniform. Seven different sizes of burners suffice for the entire range of work. They are quickly applied. A United States patent has been issued covering new features of the machine and other patents are pending relative to the torch adjustment features and the control valves.

General Electric Multi-Pole Magnetic Contactor

A size 00 alternating-current multi-pole magnetic contactor has been developed by the General Electric Co., Schenectady, N. Y., for controlling small single-phase and polyphase motors and for use as a flexible relaying device for comprehensive control systems such as are used on machine tools. Compactness and ease of installation are advantages of this contactor.

The contactor can also be furnished as a magnetic switch mounted in a small sheet-metal case suitable for general-purpose applications where atmospheric conditions are normal. Used either as a contactor or a magnetic switch, the device has a maximum rating of 10 amperes at 600 volts.

Fine silver contacts of the double-break type minimize arcing and increase the interrupting capacity, so that the contactor is able to withstand severe service. A minimum of two poles and a maximum of eight can be provided, and any combination of normally open or closed poles.

Landis Hydraulically Operated Turning Machine

A double-spindle machine designed for turning operations, which is hydraulically operated, has been developed by the Landis Machine Co., Inc., Waynesboro, Pa. This machine is the result of experiments in which a standard Landis lead-screw machine equipped with plain milling cutters in the die-head instead of threading dies was used for turning steering-gear shafts.

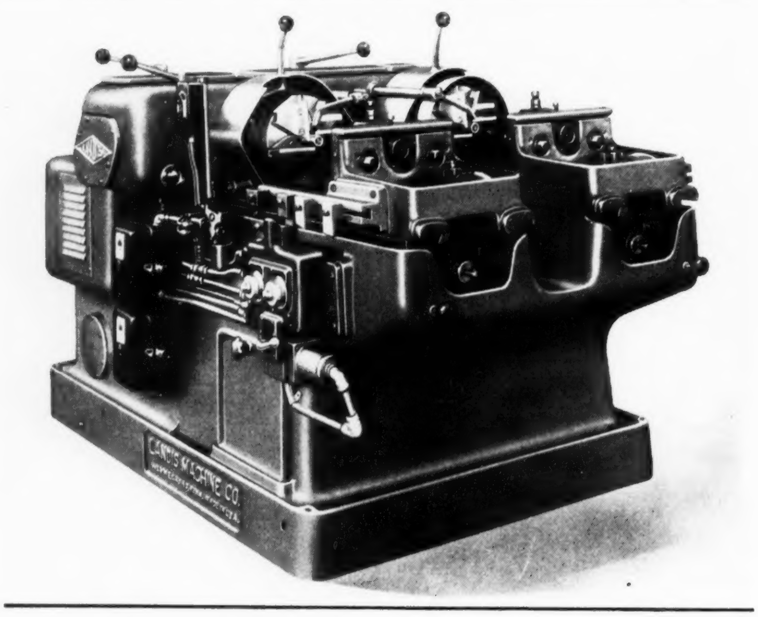


Fig. 1. Lanhydro Turning Machine with Lanco Heads that are Provided with Turning Cutters

The new machine, which has been named the Lanhydro, is hydraulically controlled and proceeds through its entire cycle automatically with one tripping of the control lever. By using the Lanco head for turning, close limits can be maintained on diameters. The head is readily adjusted to any diameter and is provided with micrometer graduations for accuracy. Owing to the fact that four cutters operate in the same plane relative to the axis of rotation and against the shoulder of the cut, round smooth turning is obtained, so that it is necessary to leave only a minimum of metal for grinding operations.

In general, the appearance of this turning machine is similar to that of the Landmaco threading machine, but a special centering device has been added for supporting the work during the turning operation. This consists of a female center backed up by a long spiral spring which maintains a constant pressure on the work. The center travels back through the spindle with the advancement of the carriage. By using a traveling cen-

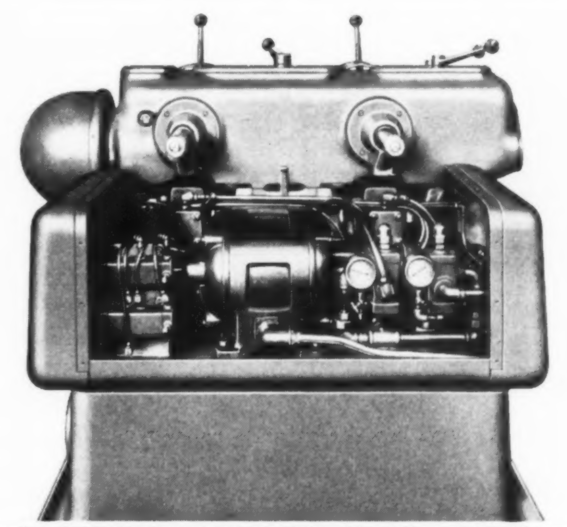
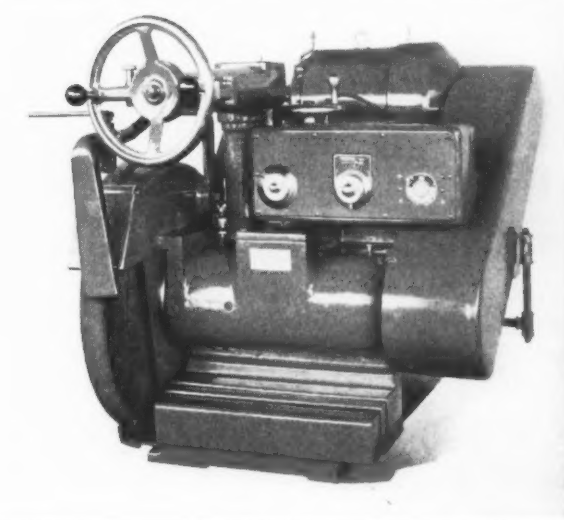


Fig. 2. Head End of Lanhydro Turning Machine, Showing Hydraulic Equipment



Bowgage Grinding Head Intended for Application to Plain Cylindrical Grinders

ter to support the work, concentricity is insured between the head of the shaft and the turned stem.

The hydraulic unit provides a rapid feed to carry the work to the turning head. A coarse turning feed is then used for machining to a point within 0.008 to 0.010 inch of the shoulder on the part. When the shoulder must be faced, a fine finishing feed is used. The length of the finishing feed is adjustable to suit any material or condition.

The carriage advances under the finishing feed to a definite stop. Then there is a variable dwell for final cleaning up and to make possible the holding of extremely close limits in the length from the end of the shaft to the face of the shoulder. After the dwell period, the turning head opens under hydraulic pressure, and the carriage returns rapidly to its starting position. The turning head closes automatically as the carriage returns.

"Bowgage" Self-Contained Grinding Head

A hydraulically controlled feed is one of the features of a self-contained grinding head recently brought out by the Fitchburg Grinding Machine Corporation, Fitchburg, Mass., for application to various makes of plain cylindrical grinding machines. This head can be operated at such automatic cycles as rapid traverse, slow grinding feed, grinding dwell or spark-out, and rapid return to the starting position. The complete cycle is effected by depressing one push-button.

The rate of grinding feed is controlled by means of a hydraulic metering valve, which is operated through a dial on the panel. The length of dwell is governed by a Telechron clock-controlled time delay switch. Another graduated dial, operated by a small handwheel, can be set to control the amount of stock removed from the work. The rate of rapid traverse is constant, and can be set at the factory to any amount up to 5 inches.

The wheel is fed through a toggle action derived from a leaf spring. One end of this spring is attached to the wheel-head slide and the other to the head. The spring is under tension and in a bowed position when the feed is started. It is flattened out hydraulically to feed the wheel-head forward. This feeding motion is relatively fast at the beginning and gradually slows down as the sizing position is reached. Feed movements can be controlled to 0.0001 inch.

Automatic Start-Stop Control and Unloader for Air Compressors

Automatic control of starting and stopping, combined with automatic loading and unloading of the air, can now be effected on motor-driven single-horizontal air compressors by using a magnetic unloader recently brought out by the Worthington Pump & Machinery Corporation, Harrison, N. J. This device operates on standard electric equipment and can be installed wherever a conventional automatic starter is employed for controlling the compressor motor. The only other requirement is a pressure switch for a pilot circuit.

If connected to the motor starter, the compressor provided with this control will start and stop on the demand for air. When connected to the magnetic unloader, the compressor will run continuously and load and unload, depending upon whether or not air is needed. The supply of cooling water can also be controlled automatically.

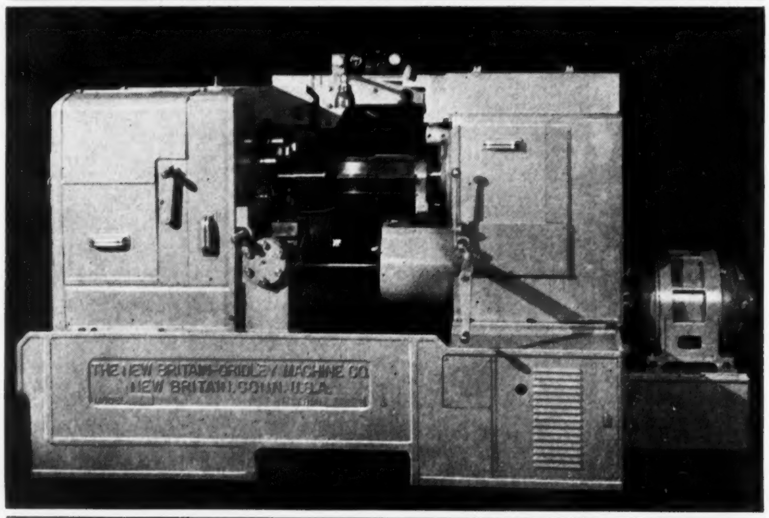


Fig. 1. New Britain Six-spindle Work-rotating Chucking Machine of 5 3/4 Inches Capacity

New Britain Six-Spindle Automatic Work-Rotating Chucking Machine

A six-spindle work-rotating chucking machine designated Model 65 has been brought out by the New Britain-Gridley Machine Division of the New Britain Machine Co., New Britain, Conn., to supplement the Models 14, 49, and 675 previously described in MACHINERY. The new model was developed especially for high-speed chucking jobs in which six tooling positions can be used to advantage. Two- or three-jaw chucks of 5 3/4 inches capacity can be supplied, or special fixtures will be furnished to suit individual requirements.

In appearance, the machine follows the box type construction of the Model 61 six-spindle automatic screw machine described in July, 1936, MACHINERY, page 747. Ample chip space and maximum tooling accessibility are features that promote easy set-up and reduce maintenance time. Rotating tools can be used in all positions of the machine, and threading or tapping attachments can be employed in the last three positions.

The machine incorporates such features of preceding New Britain screw and chucking machines as preloaded ball-bearing spindles, automatic lifting of the spindle carrier before indexing, automatic clamping of the spindle carrier after indexing, and circular-section heavy-duty cross-slides. The chucks are operated through a patented hydraulic system which supplies an instantly adjustable chucking pressure within a range from 40 to 300 pounds per square inch. Chucking is performed in conjunction with synchro-mesh positive-jaw clutches on the spindles.

The hydraulic mechanism is equipped with a device that automatically throws out the feed in case the hydraulic pressure in the chuck cylinders falls below the predetermined requirements for gripping the work. The mechanism is provided with an electric switch that is interconnected with the main drive motor so as to prevent the operation of the machine until the necessary pressure has been built up in the chucking cylinders. Indexing is prevented until the chuck is closed and the spindle clutches engaged, which eliminates the possibility of injury to the operator through indexing before the chucking has been completed. Safety devices prevent engagement of the power feed when the hand feed is in use, and there is an adjustable friction device operated through the main cam worm which prevents damage to machine parts in case jamming occurs.

There are three cross-slides mounted on large hardened and ground circular studs. Their bearing surfaces are completely enclosed to prevent chips or grit from working between them. The cross-slide cams are of the flat disk type and are jig-drilled and hardened. They are enclosed, are automatically lubricated, and can be quickly removed and transposed to any of the three cross-slide positions. A wide selective range of feeds is avail-

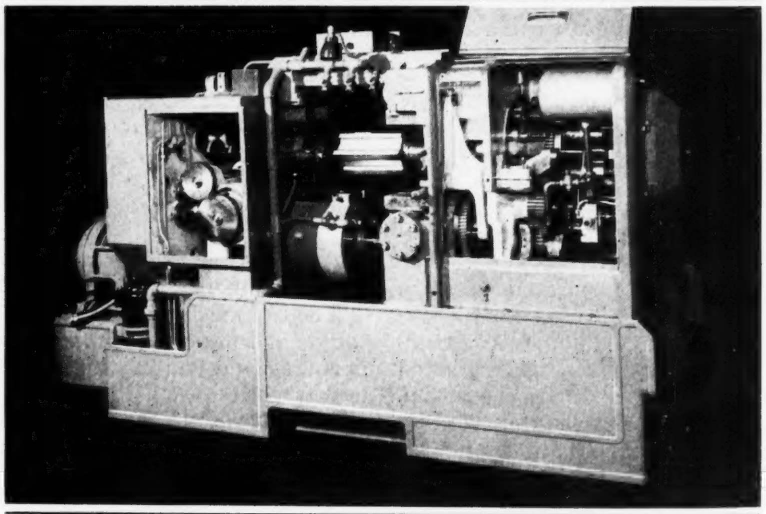


Fig. 2. Rear View of the New Britain Model 65 Automatic Chucking Machine

able for the tool-slide and cross-slides through pick-off gears. Auxiliary slides can be supplied in the Nos. 1, 5, or 6 positions for carrying threading tools, accelerated reamers, or other tools that must be operated independently of the main tool-slide.

Fractional-Horsepower Air Compressors

A new line of air compressors comprising 1/4 and 1/2 horsepower sizes has been announced by the Ingersoll-Rand Co., Phillipsburg, N. J. These units have an automatic start-and-stop control, are equipped with a seamless steel tank, and are provided with an improved check valve.

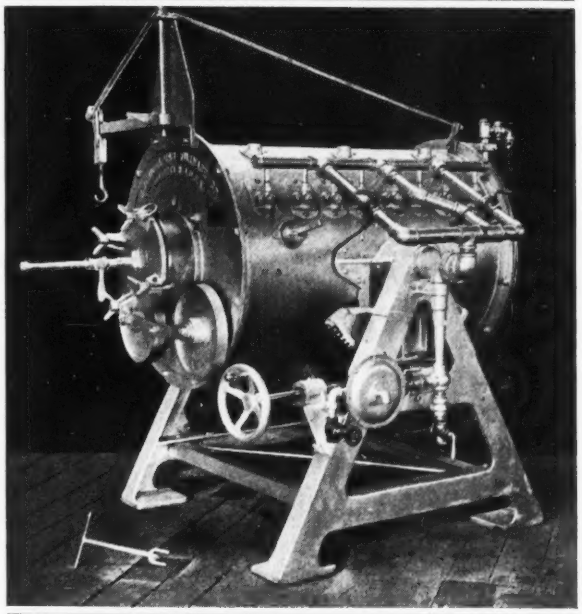
When furnished for single-phase current, the starters are equipped with a brushless capacitor type motor and a built-in automatic switch which gives overload and under-voltage protection. They have a rating of 150 pounds per square inch maximum pressure, but may be set for lower pressures. A reducing valve can also be provided to permit still lower pressures.

American Improved Rotary Gas Carburizing Furnace

A number of improvements have been made in the 600-pound capacity rotary carburizer built by the American Gas Furnace Co., Elizabeth, N. J., the improved furnace being known as Model 2-B'37. The new equipment is supplied with a lining that consists of insulating refractory material backed by block insulation, which requires much less gas consumption.

The burners are made of heat-resisting alloy and fire into special high-temperature refractory tunnels, thus insuring long life. The burners and their tunnels are easily removed for inspection and for repairs when necessary. The burners fire from one side of the machine only, giving a flame that sweeps entirely around the retort and heats uniformly at all points. Graduated sizes of burners insure uniform heating throughout the entire retort length, despite the greater radiation losses at the ends.

A simple crane facilitates handling the cover. The cover is also of an improved design, with insulation extending from the outer cover to an inner spacing disk made from a heat-resisting alloy.

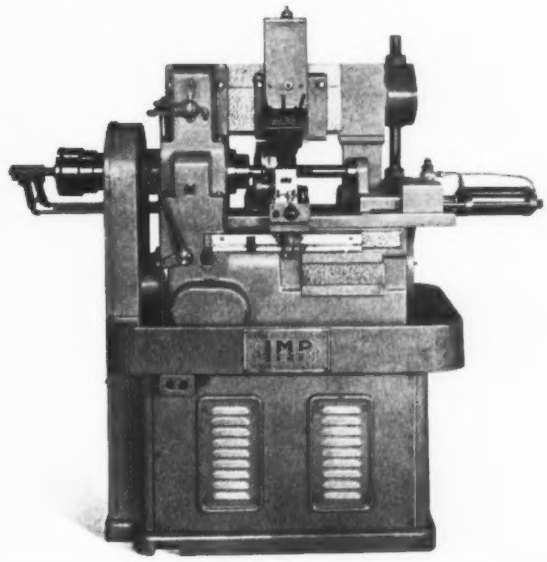


Improved Gas Carburizer Made by the American Gas Furnace Co.

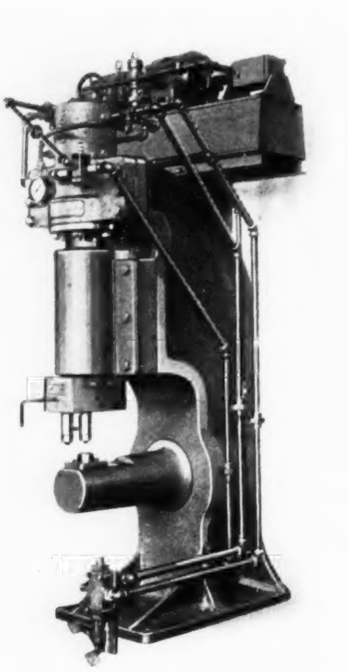
Third Slide for Lo-Swing Imp Lathes

A third slide on an over-arm is now available as a standard attachment for any of the new style Lo-Swing Imp lathes, built by the Seneca Falls Machine Co., 316 Falls St., Seneca Falls, N. Y. The operation of the third slide is synchronized with the other turning and facing slides of the machine and is entirely automatic. This slide can be used for taking a finishing cut after roughing with tools on the rear slide or for taking chamfering and similar cuts. However, the slide is also heavy enough to be used for roughing if desired.

The slide is actuated by a cam on the main camshaft. Means are provided for quickly setting this cam so that the slide can be timed to suit the particular job.



Lo-Swing Imp Lathe Equipped with a Third Slide on an Over-arm



Hydraulic Press for Inserting and Closing Boiler Spuds

Hydraulic Press for Inserting and Closing Boiler Spuds

A 75-ton hydraulic press of the downward-acting plunger type has recently been built by the Chambersburg Engineering Co., Chambersburg, Pa., for inserting and closing 1-inch boiler spuds in two operations. Boilers from 12 to 24 inches in diameter can be handled, with as great a distance as 20 inches from the end of the shell to the center-line spud. The machine is constructed with a gap frame and horn. The pressing member is a one-piston double-acting type.

The ram is provided with a double sliding upper die-holder designed for setting 3/4-inch and 1-inch spuds. The center of the spudding die is in axial alignment with the cylinder of the pressing member. The ram has a stroke of 6 inches and there is 16 inches of open space between the face of the ram and the horn at the top of the stroke.

The ram speeds are such that the two operations are performed in 6.7 seconds. The first operation consists of a 1 1/4-inch closing stroke, a 1/4-inch pressing stroke, a ram dwell lasting one second, and a 1 1/2-inch return stroke. The second operation consists of a 1 3/8-inch closing stroke, a 1/8-inch pressing stroke, a ram dwell of one second, and a return stroke of 1 1/2 inches.

The pump is driven by a five-horsepower motor, this motor as well as the pump and its reservoir being mounted on top of the press. The machine is controlled through a hand-operated valve. There is a positive automatic control of the upward travel of the ram, so that it can be operated up or down over any part of the available stroke.

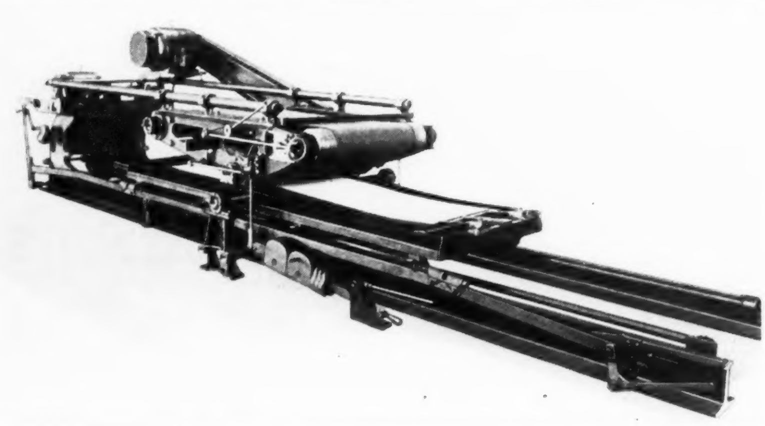
Magnus Emulsion for the Cold Cleaning of Metal Parts

The Magnus Chemical Co., Inc., Garwood, N. J., has brought out a product known as "Magnus No. 78" for the cold cleaning of metal parts by emulsion degreasing. This product does not corrode metal, is especially suitable for removing oil and grease, and will strip paint or enamel from metal surfaces. In the automotive field it may be applied for cleaning burned-on carbon from pistons, gasoline tanks before welding, burned-on oil from crankshafts, air filters, connecting-rods, etc.

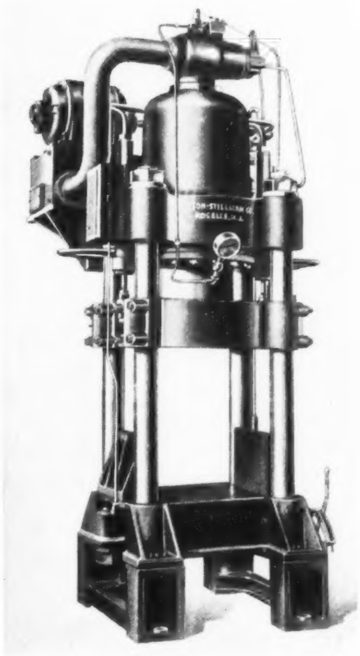
Excelsior Automatic Stainless-Steel Sheet Grinding and Polishing Machine

A No. 27-H endless belt type of machine built by the Excelsior Tool & Machine Co., Ridge Ave. from 30th to 32nd Sts., East St. Louis, Ill., is shown in the accompanying illustration. Endless belts 12 and 16 feet long, made from commercial abrasive paper of any width, can be used. The polishing head consists of two pulleys on shafts that are supported on both sides in dustproof ball bearings. There is a centrally located rubber-covered roll which applies pressure to the grinding belt by gravity. Any desired pressure can be applied uniformly over the entire width and length of the sheets being polished.

The carriage or table on which the sheet of stainless steel is placed is operated back and forth under the grinding belt mechanically any required number of times, after which the grinding head is raised, the carriage stopped at the forward end of the travel, and the finished sheet removed. The table is adjustable to suit the length of sheets being handled. A 3-H.P. motor drives the carriage, and a 40-H.P. motor the belt.



Excelsior Stainless-steel Sheet Grinding Machine of the Endless Belt Type



Watson-Stillman Hydraulic Press of 400 Tons Capacity

Watson-Stillman 400-Ton Rapid-Acting Hydraulic Press

A rapid-acting hydraulic press of the reversed cylinder type, with a self-contained power unit, has been built by the Watson-Stillman Co., Roselle, N. J., for metal forming and straightening operations. This equipment operates under a hydraulic pressure of 2500 pounds per square inch, applied on a 20-inch ram to give a maximum pressure of 400 tons. The full stroke is 24 inches.

The moving platen is advanced and returned at high speed by means of two double-acting cylinders. High pressure is automatically applied when this platen reaches the work. The operating speed with a stroke of maximum length is nine complete cycles a minute.

The movement of the main ram is controlled by a lever located at the right-hand front corner of the machine. The ram movement can be restricted to any part of the full stroke by means of adjustable collars mounted on a vertical control rod. Pressure is applied by a variable displacement pump of the radial piston type which is driven by a 30-horsepower motor. Control of the motor is effected by a magnetic switch operated through a push-button station near the control lever.

"Permochart" for Recording Instruments

A recording meter chart intended for use in plants where paper charts are ordinarily destroyed after one day's use has been placed on the market by the Permochart Co., Koppers Bldg., Pittsburgh, Pa. This new chart, which is called "Permochart," has a smooth hard surface that can be cleaned with a damp cloth.

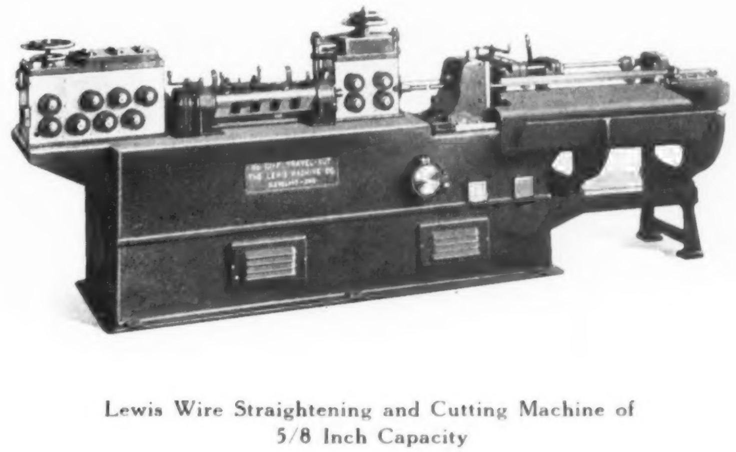
The chart is made from a wrinkleproof, waterproof, and non-inflammable material. Tests have shown charts made from this material to be serviceable for over two years. The charts can be made to fit all types of instruments used for recording temperature, pressure, vacuum, humidity, flow, speed, etc., without requiring changes in the meter.

Lewis Automatic Wire Straightening and Cutting Machine

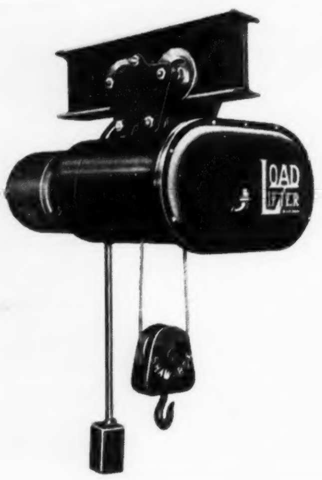
A No. 10-F "Travel-Cut" automatic wire straightening and cutting machine which feeds the wire from the coil, straightens it, gages it accurately to length, and cuts on the fly has recently been developed by the Lewis Machine Co., 1592-1600 E. 24th St., Cleveland, Ohio. This machine is similar in design to the one described in the May, 1936, number of MACHINERY, page 618, but it is of considerably heavier construction. It has a capacity for wire up to 5/8 inch in diameter, whereas the previous machine handled wire up to 1/4 inch in diameter only.

The cut-off die is fastened in a traveling head. This head has vertical ways for guiding the cut-off knife-holder, and moves forward with the wire during the cutting operation. The knife is operated by a quick-action cam on the flywheel shaft, the wire being cut during the central portion of the forward travel of the head. This permits the wire, after the clutch has been mechanically tripped, to move forward to a positive length gage which travels with the cut-off head. Accurate wire lengths are obtained without intricate adjustments of any kind.

The machine is equipped with rolls for rough-straightening the wire before it enters the rotating straightener arbor or flier. A standard five-die steel rotary straightener is used for finish-straightening. All main drive units run in a bath of oil.



Lewis Wire Straightening and Cutting Machine of 5/8 Inch Capacity



Shaw-Box Hoist Built in 350- and 700-pound Capacities

Shaw-Box Low Head-Room Electric Hoists

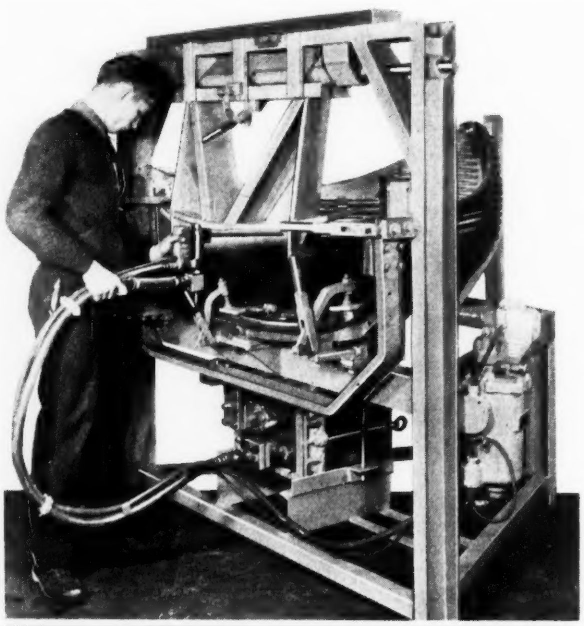
Two low head-room electric hoists, built to lift 350 and 700 pounds, have just been placed on the market by the Shaw-Box Crane & Hoist Co., Inc., Muskegon, Mich., under the trade name of "Load Lifter Junior." These hoists are replicas of the larger capacity low head-room electric hoists manufactured by the firm. The distance from the bottom of the track on which the hoists operate to the hook in its highest position is only 12 3/4 inches.

These small hoists have a lifting speed of 20 feet a minute with rated capacity loads, and have a hook lift of 18 feet. They are controlled by push-buttons contained in a unit suspended from the hoists. The hoists are comparatively light in weight, weighing only 185 pounds, complete with trolley, ready to operate.

The gear train of these hoists consists of only two gears and pinions. Ball bearings are employed throughout, and the motor is a totally enclosed ball-bearing type. Two brakes are provided—an electrically operated motor brake and an automatic mechanical load brake which holds the lowering speed to approximately the hoisting speed.

Progressive Welder Co.'s Spot-Welding Fixture

A spot-welding fixture has been placed on the market by the Progressive Welder Co., 737 Piquette Ave., Detroit, Mich., for use with the hydraulic welding gun made by this company. The parts to be welded are clamped and positioned in the fixture by quick-acting devices. The copper bus-bars are cast to fit the parts to be welded, thus insuring uniform assemblies. The transformer and hydraulic booster for the welding gun are mounted in the fixture, making a compact unit. The accessibility of all clamping devices, the means for loading and unloading with a minimum amount of handling, and the ease with which the hydraulic spot welding gun can be handled and positioned are features of this unit.



Welding Fixture Made by the Progressive Welder Co.

Alternating-current Arc Welder with Synchro Control

Ace Arc Welders with Synchro Control

Alternating-current arc welders equipped with a Synchro control which is claimed to control the amperage and voltage of the welding current in a manner that gives results comparable with those of motor-generator direct-current arc welders are being introduced on the market by the Pier Equipment Mfg. Co., 552 Cross St., Benton Harbor, Mich. A specially designed transformer with reactance is incorporated in these welders, and they employ a circuit that gives a stable non-blasting arc without spatter loss.

These welders can be used for fillet, horizontal, vertical, or overhead welding, and they can be used on material from No. 22 gage sheet metal to heavy castings. They are designed for operation on 220- or 440-volt current with a frequency of sixty cycles, and are built in capacity ratings from 15 to 250 amperes for use with welding rod ranging from 1/16 to 1/4 inch in diameter.

"Hi-Eff" Variable-Speed Control

A variable-speed transmission known as the "Hi-Eff Vari-Speed Control" is being introduced on the market by the Columbia Vari-Speed Co., Wheaton, Ill. This transmission is especially adaptable for use with such machine tools as lathes, drilling machines, and grinders. It consists of a single shaft, on which there are two adjustable V-belt pulleys which vary in diameter as their distances from the driving and driven pulleys of an equipment are changed.

The transmission provides infinite speed selectivity within ratios of 5 to 1. Simplicity, economy, and ease of installation are advantages claimed. There is only one point to be lubricated, and the pulleys are self-centering. This transmission is available in sizes from 1/4 to 7 1/2 horsepower.

Variable-speed Control Especially Suitable for Machine Tools

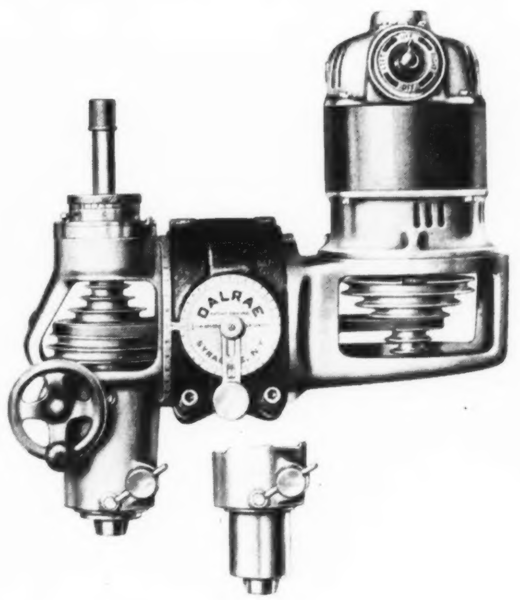
Dalrae Midgetmill

The Dalrae Tools Co., Syracuse Bldg., Syracuse, N. Y., has recently added to its line of Speedmills a new unit, the high-speed spindle of which is housed in a hardened and ground quill. This quill has a travel of 2 1/2 inches. Boring and drilling feeds are obtained through a hardened worm and a bronze worm-wheel having an internal screw thread which fits a ground screw thread on the quill. This construction gives a smooth feeding action.

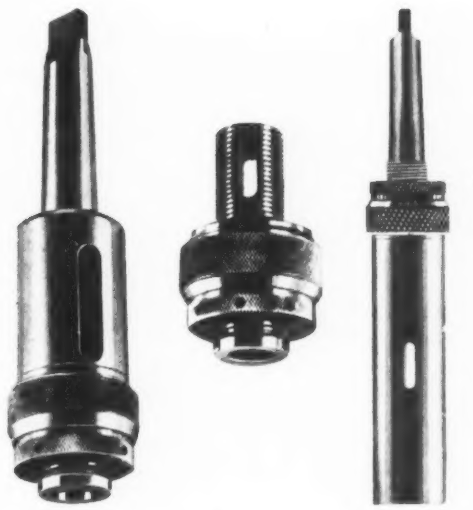
Balanced design, a flywheel type of spindle pulley, a spindle lock, an ejector rod, a self-contained plumb bob, a single mounting for compound angles, and other features common to the standard Speedmill are incorporated. There is a depth stop that "clicks" a warning when the desired depth has been reached. A micrometer dial of large diameter is provided for making accurate settings.

Buhr Micro-Holders

Three lines of quick-lock adjustable holders for drills, reamers, taps, counterbores, and spotfacers are being manufactured by the Buhr Machine Tool Co., Ann Arbor, Mich. The construction of these Micro-Holders is such that no tools are required for adjusting the taper adapter or extension. A slight turn of a sleeve locks or unlocks the knurled adjusting nut, and a turn of this nut to the right or left gives a measured adjustment in thousandths of an inch. This adjustable feature compensates for unequal wear of tools or variations in tool lengths. It also reduces the set-



Midgetmill, Placed on the Market by the Dalrae Tools Co.



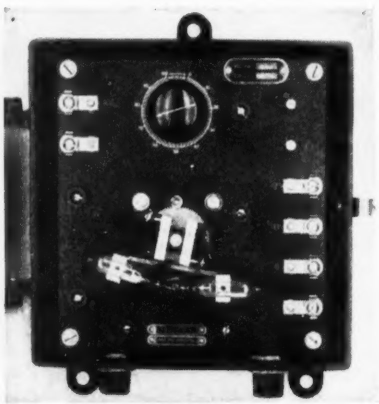
Three Micro-holders for Drills, Reamers, and Other Tools

up time in drilling, reaming, or taking other cuts to different depths.

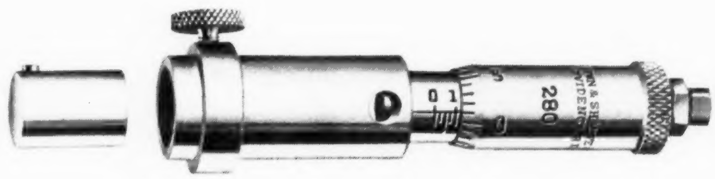
The Micro-adjustable holders and the adjustable extension holders are intended to be used in the spindle of a drilling machine, in multiple-spindle heads, and in other drilling, reaming, or counterboring machines when the spindles have a standard Morse taper hole. The Micro-adjustable nose-pieces are intended for application to spindles that have been suitably threaded. Either Buhr, General Motors, or Chrysler adjustable adapters can then be used with the nose-pieces.

"B-Linator" for Pyrometer Controllers

The Bristol Co., Waterbury, Conn., has brought out a device known as the "B-Linator" for use with automatic pyrometer controllers such as are employed on industrial heating furnaces. This device enables the pyrometer controller to anticipate temperature changes and to correct the fuel consumption long enough in advance to prevent the temperature from rising above or falling below the control point. The "B-Linator" can be used with practically all the common types of pyrometer controllers; it can be applied to present pyrometer controller installations, as well as readily incorporated in new equipment.



"B-Linator" for Use in Conjunction with Pyrometer Controllers



End Measuring Rod Equipped with Brown & Sharpe Micrometer Head

Micrometer Attachment for End Measuring Rods

A micrometer attachment designated No. 280 has been brought out by the Brown & Sharpe Mfg. Co., Providence, R. I., for application to end measuring rods, so that they can be used as inside micrometers. The micrometer head gives readings to 0.001 inch and has a movement of 1/2 inch. When a 1/2-inch spacer plug is provided, measurements can be made from 1 1/2 to 2 1/2 inches longer than when the end measuring rod alone is employed. For example, a 3-inch long measuring rod provided with the micrometer and the spacer plug takes measurements from 5 to 5 1/2 inches. The attachment fits all lengths of rods 3/8 inch in diameter.

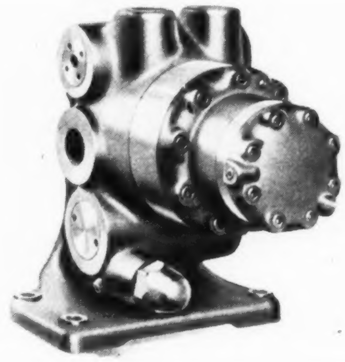
The rod or plug on the end of the micrometer head fits against a positive stop to insure accuracy of assembly. The body of the attachment is provided with a hole through which a visual check can be made of the location of the micrometer plug. The measuring point of the micrometer is adjustable and is equipped with a lock-nut.

Sundstrand WX Model Pumps

Pump units especially designed for arbor presses, clamping fixtures, indexing devices, clutches, brakes, etc., are being built in several sizes by the Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill. In these WX model pumps, quick action for the approach and return of a ram or clamping member is provided by a large capacity Sundstrand Rota-Roll pump, while the clamping or working pressure is supplied by a small-sized pump of the same type. The output of the small pump only is by-passed against the working pressure.

All control valves for the two pumps, as well as the pumps, are contained in one housing and operated by a remote pilot valve that can be either manually or automatically controlled. With such a compact design, piping is reduced to a minimum and low power consumption is obtained. There is less heating of the oil, as only the small pump is operated at high working pressures.

Both pumps are mounted on the same shaft and driven at a motor speed of 1200 revolutions per minute. The unit can be supplied with either a foot or a flange mounting. An oil reservoir with a motor base for attaching a foot-mounted unit can also be furnished, as well as any type remote pilot valve desired.



Pump Unit for Arbor Presses, Clamping Fixtures, etc.

Scrap Truck Made with a Caster Wheel or Arranged for a Lift Jack

Clark Scrap Trucks

Scrap trucks that measure 46 inches in length at the top, 27 1/2 inches in length at the bottom, and 18 1/2 inches in depth are being placed on the market by the All Steel Welded Truck Corporation, Railroad Ave. and Eighth St., Rockford, Ill. The standard equipment of these trucks includes two semi-steel wheels, 9 inches in diameter, which are provided with Hyatt type roller bearings and a Zerk fitting, and one double-row ball-bearing caster having a 6-inch wheel, which is provided with a Hyatt type roller bearing and a Zerk fitting.

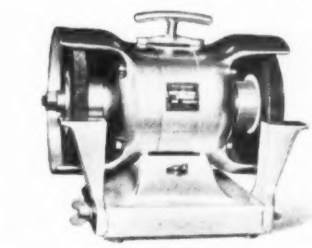
As optional equipment, the truck may be provided with a front leg and lock-pin assembly to accommodate the Clark lift jack, in place of the caster wheel. Both trucks are constructed from No. 10 gage metal with an angle-iron frame and a 1-inch pipe handle. They are electrically welded throughout.

Black & Decker 6-Inch Bench Grinder

A 6-inch Junior ball-bearing bench grinder now being placed on the market by the Black & Decker Mfg. Co., 735 Pennsylvania Ave., Towson, Md., is shown in the accompanying illustration. This grinder is finished in bright aluminum and is driven by a constant-speed motor of full 1/4 horsepower rating except with 25-cycle current, in which case the motor rating is 1/5 horsepower. The motor can be supplied for all standard alternating-current single-phase voltages and cycles.

The grinder is fully equipped with ball bearings which are protected against dust and dirt by sleeves. The wheel guards are made extra strong by the use of an alloy steel which combines lightness with high tensile strength. Ample room is provided for the use of wire-wheel brushes. The tool-rests are firmly locked in base grooves and are easily adjusted to compensate for wheel wear.

The grinder can be bolted to a bench or moved to convenient locations by means of the handle. The four rubber feet act as stabilizers. One fine and one medium wheel, each 6 inches in diameter by 5/8 inch face width, are included in the standard equipment. The net weight of the grinder is 31 1/2 pounds, and the over-all spindle length is 12 1/4 inches.



Black & Decker 6-inch Junior Bench Grinder

Litewate Drill Jig with Adjustable Clamping Pressure

The Esco Engineering Service Co., 3120 Monroe St., Toledo, Ohio, has brought out a drill jig that has the advantages of light weight and an adjustable clamping pressure. The weight is only 11 pounds, and the clamping pressure is adjustable from a few ounces to a maximum of 70 pounds.

The Esco locking and operating mechanism, described in March, 1936, MACHINERY, page 482, is employed. It consists of eccentric gears and a spring follow-up, which are located in each guide post.

Esco Light-weight Drill Jig with Clamping Pressure Adjustment

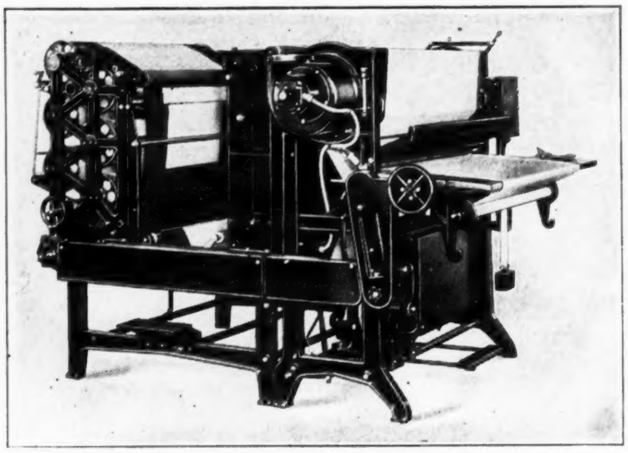
Allis-Chalmers Motor-Starter Equipped with "Ruptors"

The Allis-Chalmers Mfg. Co., Condit Works, Boston, Mass., has brought out an across-the-line air motor-starter equipped with enclosing chambers which confine and depotentiate the arc formed by interruption of the circuit. These arc-depotentiating chambers or "Ruptors," as they are called, greatly increase the interrupting ability of the contacts and form an isolating barrier between contacts of opposite polarity.

Other features of this starter

"Ruptor" Equipped Air Motor-starter

include a vertical make-and-break arrangement, silent operation, enclosed temperature-overload relays, pole units that consist of individual molded bases mounted on a steel chassis so as to insure true contact alignment, and large silver double-break contacts. The pilot circuit is isolated from the motor circuit, thus permitting a separate control voltage for a push-button circuit when necessary. This motor-starter has a rating of 7 1/2 horsepower on 440- and 550-volt circuits; 5 horsepower on 220-volt circuits; and 3 horsepower on 110-volt circuits.



Paragon Automatic Blueprinting Machine with Dryer

Paragon Automatic Blueprinting Machine

A thermostatically controlled gas or electrically heated drying unit is a feature of an automatic blueprinting machine recently developed by the Paragon-Revolute Corporation, 69 South Ave., Rochester, N. Y. This machine, designated as the Revolute 3H, has been designed to turn out flat prints that are free from wrinkles or curls. Six aluminum drying cylinders produce a calendering effect, which gives the prints a smooth finish to which dirt does not easily adhere.

Revolving contact and intense printing rays provide development facilities for making both blueprints and vandyke prints. The machine is made in 42- and 54-inch widths for continuous operation on direct or alternating current of 220 volts.

Armstrong Wrenches with "Abuse" Accessories

Heavy-duty socket wrenches recently placed on the market by the Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago, Ill., are designed especially to withstand the abuse to which wrenches are commonly subjected, such as applying a pipe on the handle to increase the leverage or striking hard blows on the handle with a hammer when a nut or capscrew does not loosen readily.

These wrenches are provided with seamless steel tubes, from 24 to 42 inches in length, which may be slipped over the wrench handle to increase the leverage up to 30 to 1. The tubes are chromium-plated on nickel. In addition, there are short "striking sleeves" of tough steel, designed to be slipped over the wrench handle when a hammer is to be applied. Both the tube handles and the striking sleeves are locked positively to the wrench handle in use.

These wrenches are made with straight, offset, and 15-degree handles. Double-hexagon openings are provided. The wrenches are forged from chromium-vanadium steel, are heat-treated, and are also chromium-plated over nickel.

Socket Wrenches with Accessories Intended to Avoid Abuse

Willson One-Piece Welding Helmet

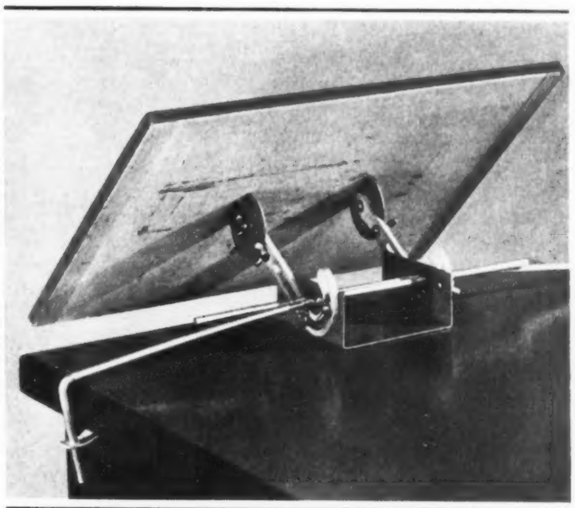
A welding helmet formed from one piece of black vulcanized fiber and cut deeply to offer side protection to a point well in back of the ears, has recently been designed by Willson Products, Inc., Reading, Pa. The usual riveted, lapped-over seams or joints are eliminated, giving a smooth rounded interior that promotes air circulation and thus gives a well ventilated, comfortable helmet. One-piece handshields have also been brought out by the concern.

One-piece Welding Helmet Made by Willson Products, Inc.

Westbrook Table Drawing Stand

A drawing-board stand for engineers and draftsmen which can be attached to a table of any size or shape has been brought out by the Westbrook Equipment Co., 10016 Greenview Ave., Garfield Heights, Cleveland, Ohio. The stand is attached to a table by simply springing down the rods at their outer ends and sliding the end pieces under the edges of the table.

The drawing-board is adjusted for height and angle by means of two arms and brackets held by bolts and wing-nuts. Sponge rubber protects the table at all contacting points.



Drawing-board Support for Use on Any Table

Numberall Wire Numbering Machine

A small power press equipped with an automatic numbering head for marking pieces of test wires has been placed on the market by the Numberall Stamp & Tool Co., Inc., 379 Huguenot Ave., Huguenot Park, Staten Island, N. Y. This unit is intended for use in wire mills and by manufacturers of screws. It is driven by a 1/4-horsepower motor.

The automatic numbering head stamps figures 1/16 inch high consecutively in a vertical position on wire pieces. Three or four wheels are generally used. The numbering head can also be furnished to stamp numbers in duplicate or triplicate.

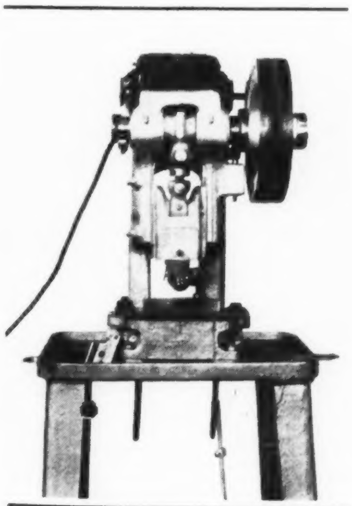
Hydraulic Scaffold with Traveling Feature

A self-contained scaffold designed for use in millwright work and plant maintenance has been brought out by the DecoVator Scaffolding Corporation, 2988 E. Grand Blvd., Detroit, Mich. This scaffold is raised and lowered hydraulically and moved about horizontally by one worker on the platform. It is driven from one point to another by mechanical means. This scaffold, designated as the "DecoVator," is made entirely of steel and is light in weight. It is easily disassembled and reassembled.

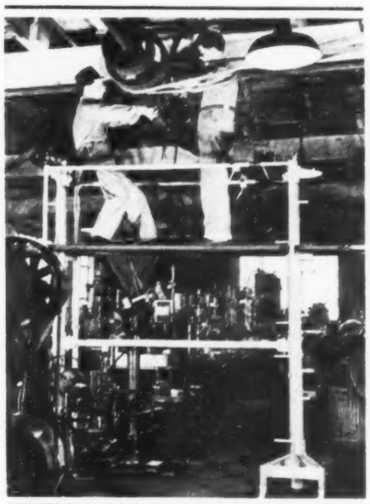
One model has a height of 2 feet 8 inches in the lowest position, and a raised height that will enable a man to work comfortably up to 16 feet. A second model, having a low height of 3 feet 2 inches, can be raised to permit working up to a height of 22 feet.

Ajax-Northrup High-Frequency Induction Forging Furnaces

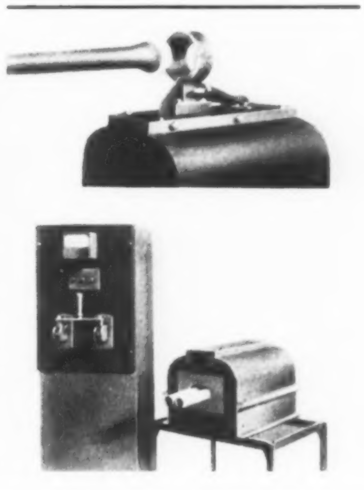
Two Ajax-Northrup high-frequency induction furnaces have been built by the Ajax Electrothermic Corporation, Trenton, N. J., for heating the ends of tubes preparatory to a series of



Power Press Equipped with Automatic Numbering Head



DecoVator Self-contained Elevating Scaffold for Shop Use



Applications of Ajax-Northrup Furnace for Heating Forgings

forging operations and for heating an end of a large tube prior to a swaging operation.

The bottom view of the illustration shows two tubes inserted in the first of these furnaces. Electric current at 2000 cycles is applied to a coil for heating a length of 6 inches on the end of both tubes to 2200 degrees F., in less than one minute. The upper view shows a special focus induction coil for heating a narrow band at the end of a tube, also to 2200 degrees F.

Heretofore, induction furnaces have been used almost entirely for melting alloy steel and, to some extent, for melting brass, bronze, and other metals.

Hand Punch for Producing Washers

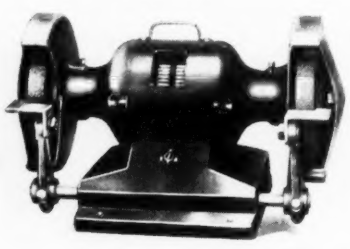
Eighteen hardened dies ranging in diameter from 1/8 inch to 1 3/8 inches are incorporated in the punching device here shown, which was designed by the Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill., for cutting washers from metal, fabric, gasket material, fiber, asbestos, Bakelite, cork, rubber, and other materials, up to 1/16 inch in thickness. With these dies, it is possible to produce washers of 150 different sizes.

Punch with Eighteen Dies for Producing 150 Sizes of Washers

The dies are mounted in an eccentric turret plate, all of them being positioned as close to the edge of the plate as possible, so as to make it convenient to center the washers and withdraw them from the device. Concentric punching is insured by the centering provision.

Diehl Electric Grinder

A 7-inch heavy-duty electric grinder for general grinding and polishing operations in machine shops, garages, woodworking plants, etc., has been placed on the market by the Diehl Mfg. Co., Elizabethport, N. J. The base is arranged for fastening firmly to a bench, table, or pedestal. Portability is facilitated by means of a handle secured to the motor yoke. The tool-rests can be set in any position to compensate for wheel wear. Steel guards enclose the 7- by 1-inch wheels, except for the working sectors.

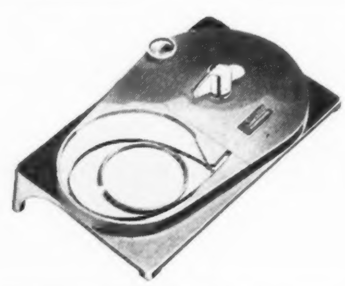


Electric Grinder Brought out by the Diehl Mfg. Co.

The ball-bearing motor, which is designed for grinder service, is totally enclosed, has a capacity of 1/2 horsepower, and operates at a speed of 3450 revolutions per minute on 110-volt, 60-cycle, single-phase alternating current.

Wilco Piston-Ring Gage

An instrument for determining the diameters of automotive piston-rings of practically all sizes has been brought out by the Wilkening Mfg. Co., 2000 S. 71st St., Philadelphia, Pa. This gage measures rings from 2 to 6 3/16 inches in diameter on the same center line. The readings are made in fractions of an inch on a dial through a powerful magnifying glass, the under sizes and over sizes also being indicated to 0.0001 inch.



Gage for Measuring Automotive Piston-rings

The scale of the gage is set at the factory to read correctly, and a master size ring is furnished with each instrument for checking the accuracy of readings at any time. Adjustments of the dial reading can be made by simply moving the scale to the right or left, so that it points exactly to the size on the dial that corresponds to the size of the master ring.

* * *

Moving Picture of Cutanit Manufacture

The manufacture and application of Cutanit cemented tungsten- and titanium-carbide tools are presented in an unusually interesting manner by a moving picture recently taken in a European plant for the American Cutting Alloys, Inc. This film was first exhibited in this country in New York City on May 4, 5, and 6. A considerable portion of the film portrays correct methods of grinding the carbide tips, in order to obtain maximum efficiency, long life, and curled or broken chips. The cutting of steel at high speed is also a feature. The film is available to universities, technical societies, and industrial plants.